BRITISH MUSEUM (NATURAL HISTORY) MAY 1987 PRESENTED

Mites of the genus *Holoparasitus* Oudemans, 1936 (Mesostigmata: Parasitidae) in the British Isles

Keith H. Hyatt

Department of Zoology, British Museum (Natural History), Cromwell Road, London SW7 5BD

Contents

Synopsis 139
Introduction 139
Material 141
External morphology 141
Summary of classification 141
Genus *Holoparasitus* Oudemans 142
Key to species 142
Descriptions of species 143
Acknowledgements 163
References 163

BRITISH MUSEUM PUBLICATIONS ISSUED 30 APR 1987 SALES OFFICE NATURAL HISTORY

Synopsis

The mites of the genus *Holoparasitus* Oudemans, 1936 occurring in the British Isles and the Channel Islands are revised. Five species are recorded of which two, *H. lawrencei* and *H. maritimus*, are new to science, and *H. calcaratus* (C. L. Koch, 1839) is recorded for the first time. A neotype is designated for *H. calcaratus*. Habitat and distribution data are given and keys to species for males and females are provided.

Introduction

The family Parasitidae comprises two subfamilies, the Parasitinae Oudemans, 1901 and the Pergamasinae Juvara-Bals, 1972. Hyatt (1980) has revised the British species of Parasitinae. Following Evans and Till (1979) the British Pergamasinae comprises the genera *Pergamasus* Berlese, 1904, *Amblygamasus* Berlese, 1904, *Paragamasus* Hull, 1918, *Holoparasitus* Oudemans, 1936 and *Pergamasellus* Evans, 1957. Of these, the first three were included by Bhattacharyya (1963) in his revision of the British species of *Pergamasus sensu lato*, whilst the monotypic genus *Pergamasellus* (of which specimens have so far been found only in two localities in southern England) is figured by Evans and Till (1979). The remaining genus, *Holoparasitus*, is revised in the present paper.

The genus *Holoparasitus* has been mentioned in the British literature scarcely a dozen times and only four authors, Halbert (1915), Hull (1918), Turk and Turk (1952) and Turk (1953), discussed their determinations. Halbert (1915) recorded *calcaratus* Koch, *pollicipatus* Berlese and *inornatus* Berlese from the west coast of Ireland, but he attached reservations to his identifications. Hull (1918) recorded the same three taxa from north-east England. Turk and Turk (1952) recorded *berlesei* Oudemans and commented on the confused synonymy of this species, echoing the remarks of Oudemans (1936), whilst Turk (1953), in his 'Synonymic Catalogue of British Acari', listed all the above names plus four of Berlese's 'varieties' based on specimens in his own collection. The remaining authors have given species determinations without comment. Where these specimens are available for study they are referred to under the taxa they are considered to represent.

Bull. Br. Mus. nat. Hist. (Zool.) **52**(4): 139–164 Issued 30 April 1987

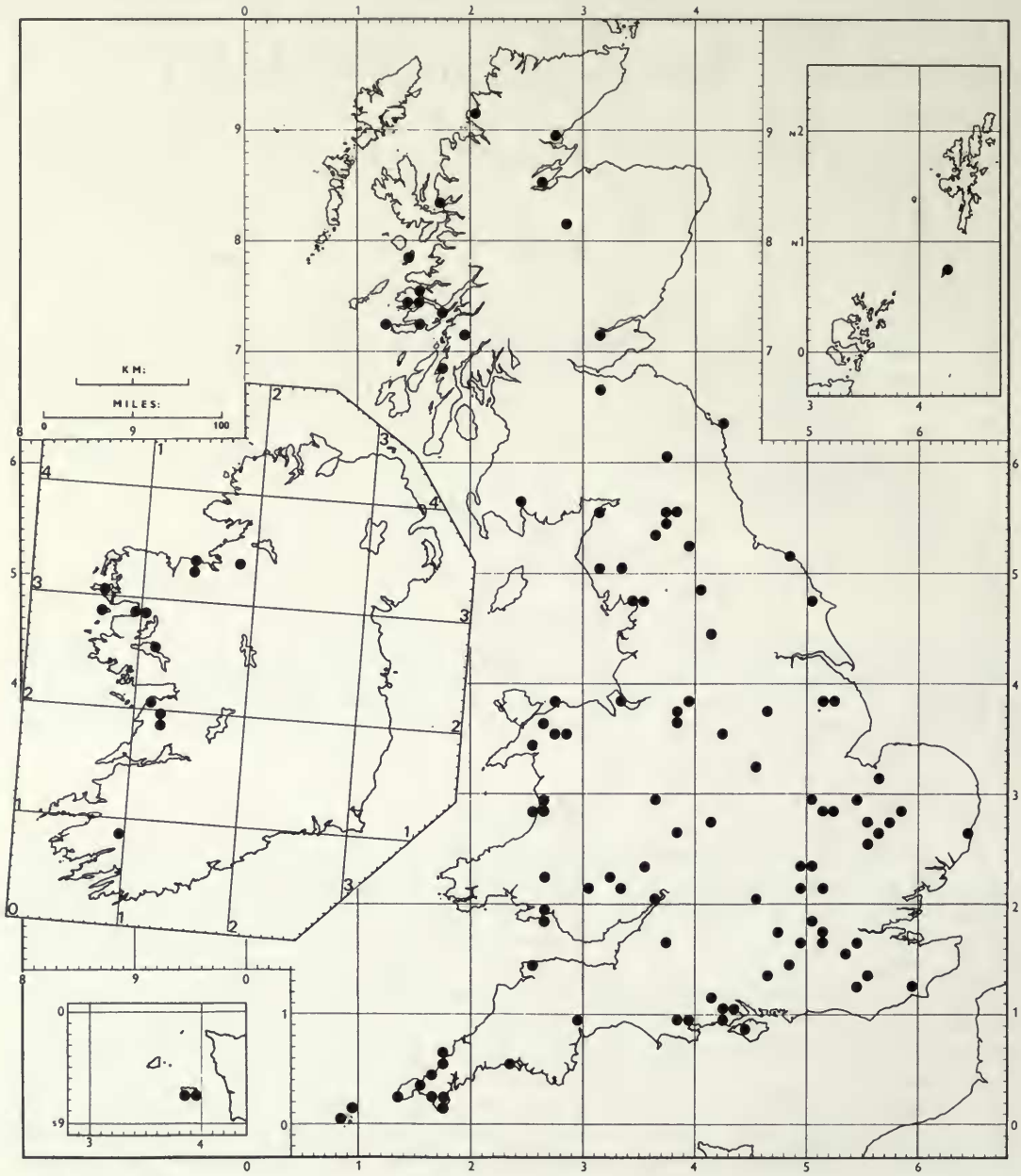

Fig. 1 The National and Irish Grids, showing to the nearest 10-kilometre square the extent of material examined during the preparation of the present work.

Mead-Briggs and Hughes (1966) recorded *Holoparasitus pollicipatus* from Cambridgeshire and Davis (1963) recorded *Holoparasitus* sp. from Northamptonshire. Unfortunately none of these specimens is available for study.

The most comprehensive revision of the European species of the genus is by Karg (1971) who keys and illustrates nine species of which three, *calcaratus, inornatus* and *stramenti* Karg, are represented in the British fauna.

Material

This revision is based on the examination of over six hundred specimens. The majority were removed from Berlese-funnel extractions during the course of my revision of the British Parasitinae (Hyatt, 1980). A few were removed from subsequent samples, mainly from areas of northern England and south-west Scotland not previously sampled. With the exception, however, of the monotypic genus *Pergamasellus, Holoparasitus* is not found so abundantly as the other genera of Pergamasinae, nor is it apparently so widely distributed.

Few named specimens were already in the Museum collections and of these the majority were in the J. H. Murgatroyd and Harry Britten collections from the New Forest area and the north of England respectively.

The map, figure 1, shows on the 10-kilometre squares of the National and Irish Grids the extent of the material from which I have examined *Holoparasitus* in the British Isles and the Channel Islands. Localities for Great Britain are given under the current English and Welsh counties and Scottish regions or island areas, but if a record is from only a small part of the area the former county name is inserted in parentheses. Additionally, large urban areas, e.g. Manchester and London, and islands or individual but prominent localities, e.g. Isle of Wight, Island of Mull, or Dungeness, are given as such.

External morphology

The external morphology of *Holoparasitus* is essentially typical of the Parasitidae and the terms used in the descriptions follow Evans and Till (1979) and Hyatt (1980). As in the majority of the Pergamasinae the dorsal setae of the idiosoma are usually of uniform length and thickness, whereas in the majority of species of Parasitinae these setae are heterogeneous. *Holoparasitus* species are usually readily separated from the other pergamasines by being conspicuously more spherical in body outline, and even under low magnifications the ventral fusion of the holodorsal and opisthogastric shields in the British species of *Holoparasitus sensu stricto* is easily seen. The exception to this last character is in the subgenera *Ologamasiphis* Holzmann, 1969 and *Heteroparasitus* Juvara-Bals, 1976 (both as yet not recorded from the British Isles) in which the two shields are not fused, although the holodorsal shield is continued ventrally, unlike *Pergamasus sensu lato* which has the holodorsal shield entirely dorsal.

Summary of classification

Oudemans (1936) proposed *Holoparasitus* as a new name for *Ologamasus* Berlese, 1906 (= *Hologamasus* [lapsus] Berlese, 1892) with the type species *Gamasus calcaratus* C. L. Koch, 1839. The type species of *Ologamasus* Berlese, 1888 is, by monotypy, *Gamasus aberrans* Berlese, 1888, a member of the family Rhodacaridae (Ryke, 1962, Lee, 1970).

The first comprehensive review of the genus *Holoparasitus* was contained in Berlese's 'Monografia del genere *Gamasus* Latr.' published in 1906. In this work the following ten taxa are recognised: *Gamasus (Ologamasus) calcaratus* Koch, 1839 and its two varieties, *excisus* Berlese, 1906 and *siculus* Berlese, 1906; *Gamasus (Ologamasus) inornatus* Berlese, 1906; *Gamasus (Hologamasus) pollicipatus* Berlese, 1904 and its five varieties *appeninorum, cultriger, excipuliger, peraltus,* and *pseudoperforatus,* all Berlese, 1906.

Oudemans (1936) considered that Berlese's *pollicipatus* and Koch's *calcaratus* were both synonyms of the earlier *Acarus lichenis* Schrank, 1781. However, Micherdzinski (1969) considered that Oudemans had no real evidence for this, bearing in mind that Schrank's figures were so lacking in detail.

Of the recent authors Holzmann (1969) uses the name *Ologamasus* Berlese, 1892, with which she erroneously considers *Holoparasitus* to be synonymous. She recognises two subgenera, *Ologamasus s. str.* and *Ologamasiphis* nov., separated by several characters of the deutonymph

and the female. In the subgenus *Ologamasus s. str.* she includes *calcaratus* Koch, 1839, *inornatus* Berlese, 1906, *hemisphaericus* Vitzthum, 1923, *absoloni* Willmann, 1940 and *intermedius* Holzmann, 1969, whilst in *Ologamasiphis* she includes *rotulifer* Willmann, 1940 and a new species, *minimus* Holzmann, 1969.

Micherdzinski (1969) follows Oudemans in his preference for *Holoparasitus* and divides the genus into four species-groups: 1. *calcaratus*-group and 2. *pollicipatus*-group, both based on the form of the femoral spurs on leg II of the male, 3. *Ologamasiphis*-group with *H. rotulifer* and *H. minimus* following Holzmann, and 4. a group to include females which do not belong to previous groups, *H. excisus* (Berlese) and *H. hemisphaericus* (Vitzthum).

Karg (1971), at couplet twelve in his key to females, recognises the subgenus *Ologamasiphis* for three species, *minimus* Holzmann, *coronarius* Karg (nom. nov. pro *rotulifer* Holzmann, 1969, non Willmann, 1941) and *tirolensis* Sellnick, 1968, implying that the preceding species belong to *Holoparasitus s. str.*

Genus ***HOLOPARASITUS*** Oudemans

Hologamasus Berlese, 1904: 235. Non Berlese, 1892: 62.
Ologamasus Berlese, 1906: 242. Non Berlese, 1888: 194.
Holoparasitus Oudemans, 1936: 164.

TYPE SPECIES: *Gamasus calcaratus* C. L. Koch, 1839.

Dorsal and ventral shields of the adults well sclerotised; males with holodorsal and opisthogastric shields always fused posteriorly; females with holodorsal and opisthogastric shields fused posteriorly in *Holoparasitus s. str.*, but free in the subgenus *Ologamasiphis* Holzmann. Deutonymphs with separate podonotal and opisthonotal shields, not strongly sclerotised. In all stages setae of dorsal hexagon, i.e. *j5, z5* and *j6*, similar to each other and not differing markedly from the remaining dorsal stage which are generally short (not exceeding 50 μm) and often inconspicuous. Tritosternum of male biramous and sometimes modified, base closely associated with genital orifice. Tristosternum of deutonymph and female normal, biramous. Junction between sternal and metasternal shields of female olique. Genital shield of female broadly pentagonal. Opisthogaster with usually not more than 15 pairs of setae. Setae *al* of palp trochanter bifid and with one or more distinct slender processes; setae al_1 and al_2 of palp femur entire, spatulate or setiform. Corniculi strong, entire or notched internally. Legs of deutonymph and female without spurs; only leg II of male spurred. Lobes of pulvilli normal, rounded.

Key to species

Males

1 Apophysis on femur II thumb-shaped, about twice as long as axillary process (Fig. 2G) . . 2
– Apophysis on femur II short, hemispherical and not extending beyond the blunt axillary process (Fig. 8G) 3
2 Sternogenital shield with a conspicuous 'excipulum' medially between coxae II and III (Fig. 2B); majority of dorsal setae extremely short (*c.* 10–20 μm) (Fig. 2A); idiosoma 590–635 μm . . . . . ***Holoparasitus calcaratus*** (C. L. Koch) (p. 143)
– Sternogenital region without such a median 'excipular' mark; dorsal setae generally exceeding 25 μm in length; idiosoma 520–570 μm . . . . . ***Holoparasitus stramenti*** Karg (p. 146)
3 Anterior margin of sternogenital shield strongly concave medially to behind sternal setae I; a conspicuous and shallow transverse structure line present at sternal setae II (Fig. 8B); idiosoma 530–590 μm . . . . . ***Holoparasitus inornatus*** (Berlese) (p. 151)
– Anterior margin of sternogenital shield not strongly concave medially; sternal ornamentation otherwise; idiosoma exceeding 680 μm 4
4 Large species – idiosoma 780–840 μm; sternal region with a light but strongly procurved line reaching forward from sternal setae II (Fig. 10B); tectum trispinate, centre spine long (Fig. 10C); corniculi smooth . . . . . ***Holoparasitus lawrencei*** sp. n. (p. 155)
– Smaller species – idiosoma 680–750 μm; sternal region with reticulations only; tectum broadly triangular, granular (Fig. 13C); corniculi cleft on inner margins (Fig. 13G) . . . . . ***Holoparasitus maritimus*** sp. n. (p. 158)

Females

1 Genital shield produced anteriorly to a tongue-shaped apex (Fig. 6B); endogynium as in figure 6C; idiosoma 590–670 µm . . . . . ***Holoparasitus stramenti*** Karg (p. 146)
– Genital shield with anterior margin forming an obtuse to right angle, with or without a small protruding tip (Fig. 9B) 2
2 Sternal shield divided longitudinally into two (Fig. 9B); endogynium appears as a circular granular structure (Fig. 9C); idiosoma 610–690 µm . . . . ***Holoparasitus inornatus*** (Berlese) (p. 151)
– Sternal shield entire (Fig. 11B) 3
3 Sternal shield with a pair of indentations on the anterior margin internally to sternal setae I (Fig. 3B); endogynium as in figure 3C; majority of dorsal setae extremely short (*c.* 10–25 µm) (Fig. 3A); idiosoma 670–720 µm . . . . . ***Holoparasitus calcaratus*** (C. L. Koch) (p. 143)
– Sternal shield with anterior margin smooth, without indentations 4
4 Sternal shield granular, with a distinct median pattern, pre-sternal shields entire or divided, strongly denticulate (Fig. 14B); endogynium as in figure 14C; idiosoma 770–810 µm . . . . . ***Holoparasitus maritimus*** sp. n. (p. 158)
– Sternal shield smooth, no distinct median pattern; pre-sternal shields entire or divided, granular (Fig. 11B); endogynium as in figure 11C; idiosoma 850–920 µm . . . . . ***Holoparasitus lawrencei*** sp. n. (p. 155)

Descriptions of species

Holoparasitus calcaratus (C. L. Koch)
(Figs 2A–G, 3A–G)

Gamasus calcaratus C. L. Koch, 1839: Heft 26, Taf. 6.
Gamasus timidulus C. L. Koch, 1839: Heft 26, Taf. 7.
Gamasus (Ologamasus) calcaratus: Berlese, 1906: 245.
Holoparasitus calcaratus: Micherdzinski, 1969: 354.
Ologamasus (Ologamasus) calcaratus: Holzmann, 1969: 47.
Holoparasitus excipuliger: Karg, 1971: 361. Non Berlese, 1906.
Ologamasus pollicipatus Berlese, 1904; 1913: 203 (in part).

Designation of a neotype

Oudemans (1906, 1929, 1936) opined that *Gamasus timidulus* C. L. Koch (♀) and *Gamasus calcaratus* C. L. Koch (♂) were junior synonyms of *Acarus lichenis* Schrank, 1781. However, Schrank's and Koch's specimens are no longer in existence and although Micherdzinski (1969) and Karg (1971) have accepted that *timidulus* is a synonym of *calcaratus*, they have not accepted the validity of *lichenis*. Since Oudemans (1936) it has been universally accepted that *calcaratus* is the type of *Holoparasitus*, but, unfortunately, authors' concepts of *calcaratus* have not been consistent. Specimens labelled *Ologamasus pollicipatus* in the set of slides accompanying the *Acarotheca Italica* (Berlese, 1913) in the BM(NH) collection are referable to the present species, whereas the specimens similarly labelled in the set in the Oudemans collection are *rotulifer* Willmann, 1940.

Through the courtesy of Dr L. van der Hammen I have been able to examine material from several places very close to Regensburg, the type locality. Of the 15 samples of Gamasina examined, seven contained *Holoparasitus* and of these six contained specimens of *H. calcaratus*. One sample contained a single male and female of another species.

A female from Dechbetten, 1·5 miles (2 km) west of Regensburg, Bavaria, 19 July 1959, in rotting dry litter, L. van der Hammen coll., is designated as the neotype of *Gamasus calcaratus* C. L. Koch. The specimen is deposited in the Rijksmuseum van Natuurlijke Historie, Leiden, together with deutonymphs, males and other females from the same sample. Three males, three females and one deutonymph from this sample are retained in the British Museum (Natural History) through the courtesy of Dr van der Hammen.

MALE. The holodorsal and opisthogastric shields, which are fused ventrally posterior to coxae IV, are strongly sclerotised and completely reticulated (Figs 2A, B). The dorsum (Fig. 2A) measures 590–635 µm long × 430–480 µm wide and bears over 50 pairs of simple setae ranging in length from

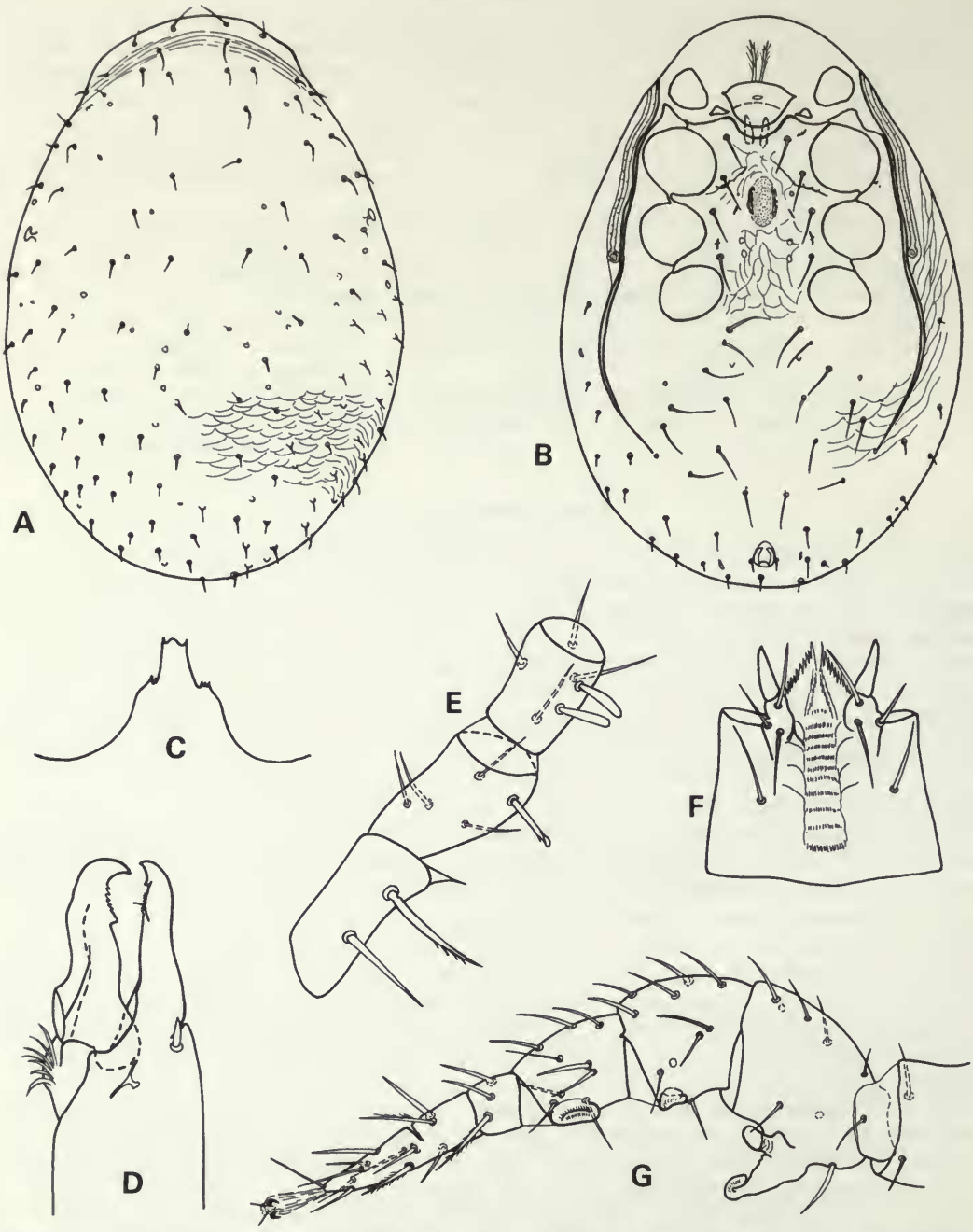

Fig. 2 *Holoparasitus calcaratus* (C. L. Koch), **male** – A dorsum, B venter, C tectum, D chelicera, E palp trochanter, femur and genu, F venter of gnathosoma, G leg II.

35 μm (the vertical setae, *j*1) to 10 μm or less for the majority in the opisthonotal region. The setae are not arranged entirely symmetrically.

The tritosternum comprises two slender pilose laciniae that arise from below the anterior margin of the genital lamina (Fig. 2B). The sternogenital region is strongly reticulated and bears medially between coxae II and III a conspicuous oval mark (the 'excipulum' of Berlese). The sternogenital

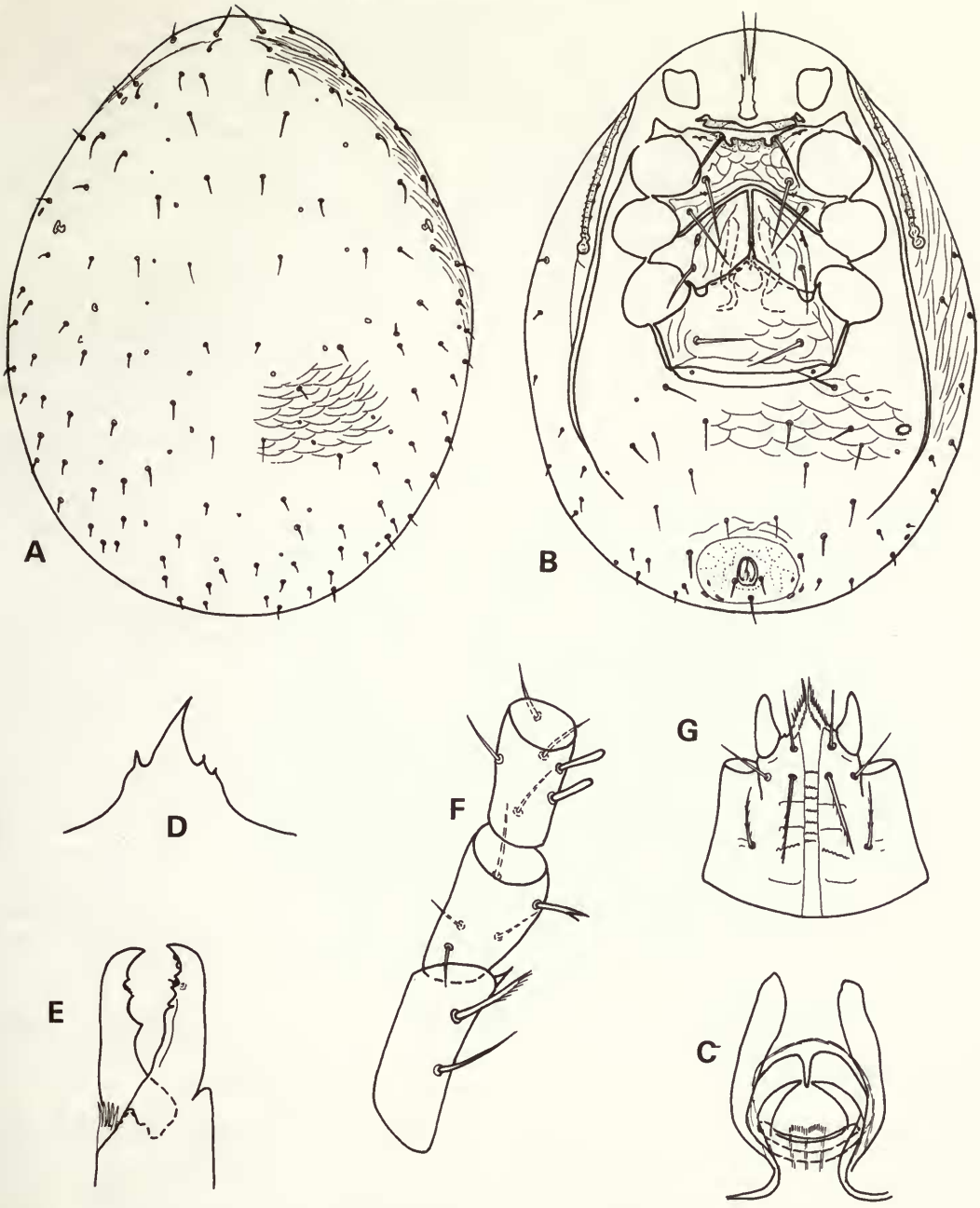

Fig. 3 *Holoparasitus calcaratus* (C. L. Koch), **female** – A dorsum, B venter, C endogynium, D tectum, E chelicera, F palp trochanter, femur and genu, G venter of gnathosoma.

and median opisthogastric setae are up to 40 μm in length, whilst the three anal setae and those situated posteriorly in the opisthogastric region are as little as 10 μm. The stigma is situated opposite the posterior margin of coxa III and the peritreme extends anteriorly to coxa I.

The tectum is shown in figure 2C. The median portion is broad and blunt in all specimens examined and the lateral teeth vary. The chelicera is shown in detail in figure 2D. The movable digit

is 75 μm long and bears one large tooth and 5–6 small, sometimes irregular, teeth. The fixed digit bears one sometimes blunt tooth towards the tip and up to seven very small teeth in the region of the pilus dentilis. The palp trochanter, femur and genu are shown in figure 2E. The anterolateral setae of the femur and genu are spatulate, that on the genu is more slender and is bifurcate near to its tip. The corniculi (Fig. 2F) are strong and stalked and all the gnathosomal setae are simple. Leg II is shown in detail in figure 2G. The femoral apophysis is thumb-shaped and is about twice as long as the axillary process. The ventral process on the genu is short and rounded whilst that on the tibia is elongate and bean-shaped. All leg setae are slender whilst a number on the tarsi of legs II–IV are stronger and pilose on one margin. The ambulacra are normal.

FEMALE. The holodorsal and opisthonotal shields, which are strongly sclerotised and completely reticulated, are fused ventrally anterior to the anus (Figs 3A, B). The dorsum (Fig. 3A) measures 670–720 μm long × 500–560 μm wide and bears up to 57 or more pairs of simple setae, about 20 pairs being in the podonotal region and from 34–37 pairs in the opisthonotal region. The vertical setae, *j1*, are the longest and measure *c.* 40 μm, whilst the shortest setae, the majority of those in the opisthonotal region, measure as little as 10 μm and are extremely fine.

The tritosternum (Fig. 3B) has a narrow base and the paired laciniae are simple. The presternal shields are fused to form a single narrow bar. The ventral shields are strongly reticulated and all setae are simple. The sternal shield has a pair of indentations on the anterior margin inwards from sternal setae I. The reticulations show a bold procurved transverse line extending from posterior to coxae II through sternal pores II. The genital shield measures 130–160 μm long × 210–220 μm wide. Its anterior margin is formed into a slight obtuse angle or right angle and bears a slender pointed tip. The endogynium is shown in figure 3C and in the specimens examined shows constancy in form despite clearing for examination. The opisthogastric region bears 8–9 pairs of setae. The longest of the ventral setae are sternal setae II and III which measure up to 75 μm. The shortest ventral setae are around the posterior margin and measure 10 μm or less. In most of the specimens examined the outline of the deutonymphal anal shield is retained. The stigma is situated opposite the posterior margin of coxa III and the peritreme extends anteriorly to coxa I.

The tectum (Fig. 3D) has the centre portion tapered and sinuous. The chelicera is shown in figure 3E. The movable digit measures 87 μm and bears three prominent teeth and two small teeth, whilst the fixed digit bears five teeth decreasing in size towards its tip. The palp trochanter, femur and genu are shown in figure 3F. The anterolateral seta of the genu is bifurcate whilst those of the tibia are spatulate. The venter of the gnathosoma is shown in figure 3G. The internal posterior hypostomatic setae are the longest (70 μm or more) and with the palpcoxal setae are pilose, at least on one margin. The hypognathal groove shows only about seven rows of denticles. The leg setae are slender and a few on the tarsi are pilose on one margin. The ambulacra are normal.

MATERIAL EXAMINED. 14 samples – 7 ♂♂, 16 ♀♀.

ENGLAND: Hampshire, Surrey, Sussex/Kent border near the coast, Cambridgeshire (including Huntingdonshire).

This species is recorded mainly from grasses and leaf-litter in damp habitats.

As far as I can establish, there are no previous authenticated records from the British Isles.

Holoparasitus stramenti Karg
(Figs 4A–F, 5A–G, 6A–G)

Holoparasitus stramenti Karg, 1971: 356.
Gamasus (Ologamasus) calcaratus var. *excisus* Berlese, sensu Halbert, 1915: 54 (in part).
Gamasus (Ologamasus) pollicipatus Berlese, sensu Halbert, 1915: 55.
Holoparasitus pollicipatus (Berlese) sensu Browning, 1956: 386.

DEUTONYMPH. The lightly reticulated dorsal shields are weakly sclerotised and yellowish-brown in colour. The podonotal shield averages 235 μm long × 325 μm wide. It bears 17 pairs of simple slender setae, none longer than 30 μm (Fig. 4A). The opisthonotal shield averages 180 μm long × 225 μm wide and bears 12 pairs of simple slender setae from 20–25 μm in length. The surrounding membrane bears dorsally on each side about 20 short, simple setae.

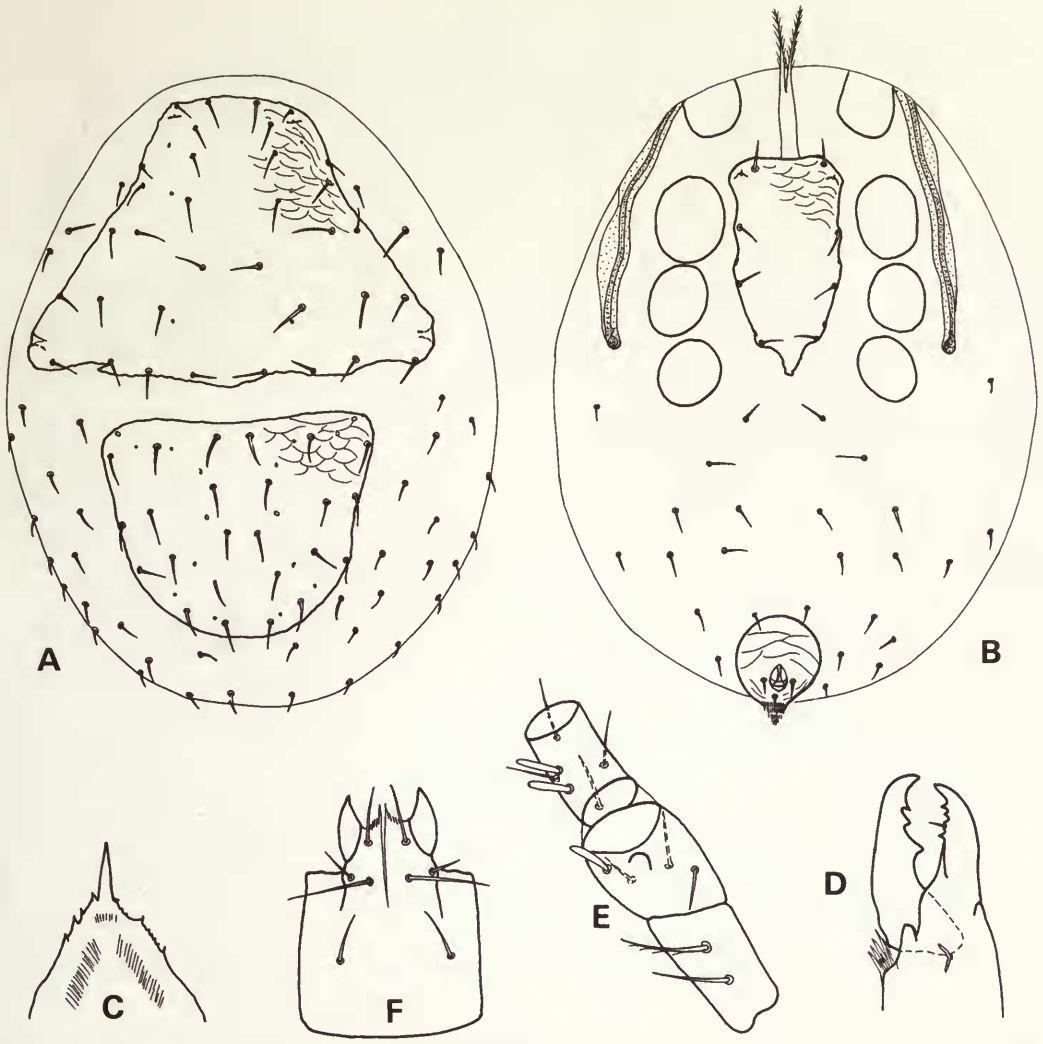

Fig. 4 *Holoparasitus stramenti* Karg, **deutonymph** – A dorsum, B venter, C tectum, D chelicera, E palp trochanter, femur and genu, F venter of gnathosoma.

The tritosternum has a narrow base and pilose laciniae. The sternal shield (Fig. 4B) averages 180 μm long and is lightly reticulated and weakly sclerotised. The sternal setae average 25 μm long and are simple. Pre-sternal shields absent. The oval anal shield bears the usual three setae, each simple and about 12 μm in length. The stigma is situated opposite the anterior margin of coxa IV, and the granular peritreme and peritrematal shield extend anteriorly to the level of coxa I. The 11 to 15 or more pairs of simple opisthogastric setae are slender.

The triangular tectum is serrated anteriorly and bears a slender tip (Fig. 4C). The chelicerae are as in figure 4D, the movable digit measures 58 μm in the figured specimen. The palp trochanter, femur and genu are shown in figure 4E. The anterolateral setae of the femur and genu are spatulate. The corniculi and the venter of the gnathosoma are as in figure 4F, the gnathosomal setae being simple with the internal hypostomatics the longest. The hypognathal denticles are not discernible. All leg setae are slender, the majority are simple but some, especially on tarsus II, are finely pilose on one margin. The pulvilli are normal, rounded and with two claws.

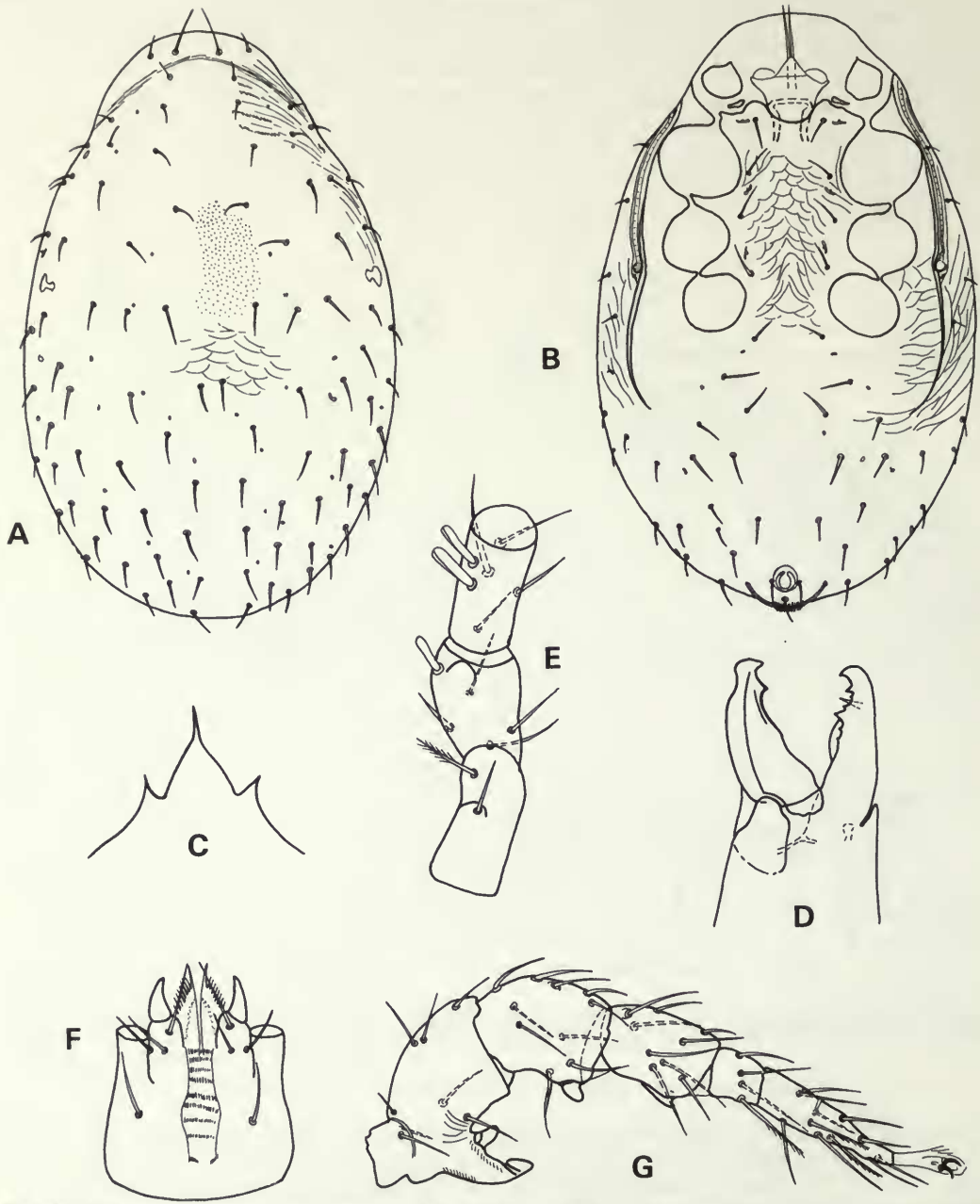

Fig. 5 *Holoparasitus stramenti* Karg, **male** – A dorsum, B venter, C tectum, D chelicera, E palp trochanter, femur and genu, F venter of gnathosoma, G leg II.

MALE. The holodorsal and opisthogastric shields, which are strongly sclerotised and completely reticulated, are fused ventrally anterior to the anus (Figs 5A, B). The dorsum (Fig. 5A) measures 520–570 μm long × 330–400 μm wide, is finely granular and bears 45 pairs of simple setae, 20 pairs in the podonotal region and 25 pairs in the opisthonotal region. The vertical setae, *j1*, are the longest, measuring up to 45 μm. The remaining setae are 20–25 μm long.

The tritosternum comprises two slender laciniae which arise from below the anterior margin of the genital lamina (Fig. 5B). The sternogenital region is reticulated and the pattern is constant for

the species. The sternogenital setae and the median opisthogastric setae are the longest – up to 45 μm – whilst the remainder are considerably shorter. The three anal setae are simple. The stigma is situated opposite the posterior margin of coxa IV and the peritreme extends to coxa I.

The tectum (Fig. 5C) is normally symmetrically formed and is trispinate. The chelicera is shown in figure 5D; the movable digit is 50 μm long in the figured specimen and bears a single tooth near the tip, whilst the fixed digit bears two prominent teeth and about four smaller ones. The palp trochanter, femur and genu are shown in figure 5E. The anterolateral setae of the femur and genu are spatulate. The venter of the gnathosoma is as in figure 5F. The corniculi are stalked and strong. The gnathosomal setae are simple and the hypognathal groove bears about nine rows of denticles. Leg II is shown in detail in figure 5G. The femoral apophysis is strong and thumb-like whilst the axillary process is short, but elongate. The ventral process on the genu is swollen, whilst that on the tibia is not prominent. All the leg setae are slender, some on the tarsi being pilose on one margin. The ambulacra are normal, with rounded pulvilli and two claws.

FEMALE. The holodorsal and opisthogastric shields, which are strongly sclerotised and completely reticulated, are fused ventrally anterior to the anus (Figs 6A, B). The dorsum (590–670 μm long × 410–475 μm wide) is finely granular and bears 48–49 pairs of simple setae (Fig. 6A), 20 pairs in the podonotal region and 28–29 pairs in the opisthonotal region. The vertical setae, *j1*, are the longest, measuring up to 40 μm. The remaining setae are about 20–25 μm in length.

The tritosternum (Fig. 6B) has a narrow base and pilose laciniae. The presternal shields are fused to form a strong transverse bar, occasionally with a small section at each end being almost or entirely detached. The ventral shields are completely reticulated and are granular. The reticulations on the sternal shield follow a definite, but simple, pattern with a pair of oblique lines originating from the angle between coxae II and III and passing through sternal pores II, but petering out before reaching the centre of the shield. The genital shield measures 130–183 μm long × 190–225 μm wide, its size appearing to be related to the actual size of the specimen. The genital shield is unique among the British species of the genus in that it is produced anteriorly into a strong tongue-shaped apex. The endogynium is shown in figure 6C; its general content appears constant, but the position of the 'teeth' varies considerably due to distortion in life or during preparation for examination. The opisthogastric region bears 8–9 pairs of setae. The sternal setae are the longest – *c.* 45 μm – and the metasternal, genital and opisthogastric setae decrease slightly in length in that order. The three anal setae are short (*c.* 12 μm) and simple. The stigma is situated opposite the posterior margin of coxa III and the peritreme extends anteriorly to the level of coxa I.

The tectum (Fig. 6D) is similar to that of the male, but in some specimens irregularity is present. The chelicera is as in figure 6E. The movable digit measures 82 μm in the figured specimen and bears three teeth, whilst the fixed digit bears up to six less prominent teeth. The palp trochanter, femur and genu are shown in figure 6F. The anterolateral setae of the femur and genu are spatulate. The venter of the gnathosoma is shown in figure 6G. The palpcoxal setae are pilose on one margin whilst the other gnathosomal setae are simple. The hypognathal groove bears about eight rows of denticles. Some of the leg setae are finely pilose on one margin. The ambulacra are normal.

MATERIAL EXAMINED. 93 samples – 3 DNN, 80 ♂♂, 178 ♀♀.

ENGLAND: Isles of Scilly, Devon, Somerset, Berkshire, Hampshire, Surrey, Sussex, Kent, Middlesex, Hertfordshire, Buckinghamshire, Gloucestershire, Bedfordshire, Norfolk, Suffolk, Cambridgeshire (including Huntingdonshire), Hereford and Worcester, Leicestershire, Cheshire, North Yorkshire, Cumbria (Cumberland, Westmorland), Northumberland.

SCOTLAND: Lothian/Borders, Strathclyde (Argyllshire), Tayside (Perthshire), Inner Hebrides (Mull, Iona, Eigg).

WALES: Gwynedd (Caernarvonshire), Dyfed (Cardiganshire), Clwyd, Gwent, Glamorgan.

IRELAND: Galway, Mayo, Clare, Leitrim.

CHANNEL ISLANDS: Jersey.

Although this species has been collected from leaf-litter, compost, moss and grassland, it has a marked preference for wet, marshy habitats. One female from Co. Mayo, Ireland, was taken on the seashore.

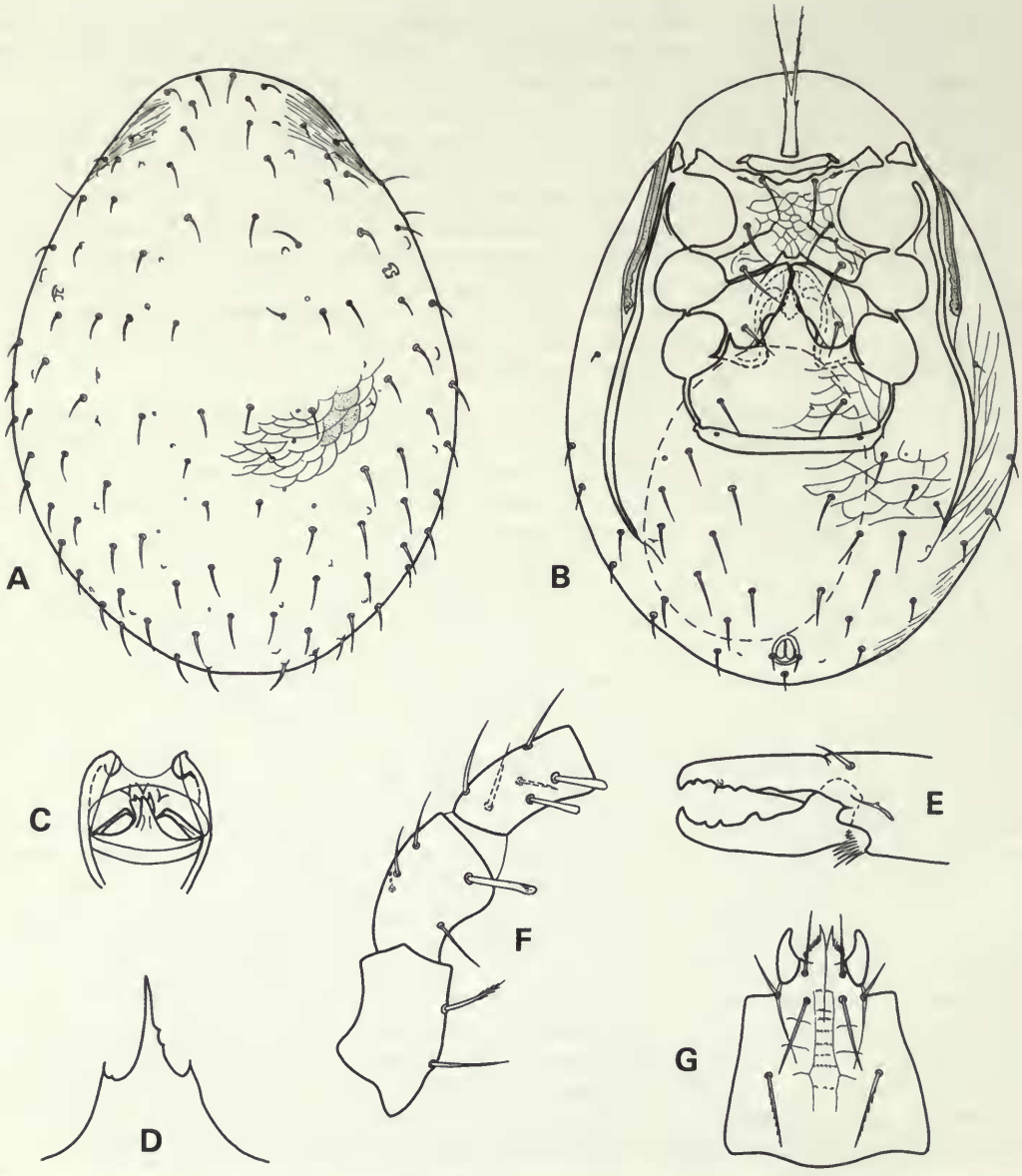

Fig. 6 *Holoparasitus stramenti* Karg, **female** – A dorsum, B venter, C endogynium, D tectum, E chelicera, F palp trochanter, femur and genu, G venter of gnathosoma.

DISTRIBUTION. Karg (1971) stated that the holotype of this species came from the Baltic coast and gave its distribution as central Europe. The name has not appeared subsequently in the literature. *H. stramenti* is one of the two most abundant British members of the genus. It was recorded from Co. Mayo, Ireland, by Halbert (1915) as *Gamasus (Ologamasus) calcaratus* var. *excisus* Berlese from Achill Island and Westport, and as *Gamasus (Ologamasus) pollicipatus* Berlese from Clare Island. Two females of this species were recorded from Jersey by Browning (1956) as *Holoparasitus pollicipatus* (Berlese). A single undetermined female was recorded from Moor House National Nature Reserve, Westmorland, by Block (1965), whilst Davis (1970) recorded a single female from Monks Wood National Nature Reserve as *Holoparasitus ?pollicipatus*.

Holoparasitus inornatus (Berlese)
(Figs 7A–F, 8A–G, 9A–G)

Gamasus (Ologamasus) inornatus Berlese, 1906: 257.
Holoparasitus inornatus: Schweizer, 1961: 34 (♀ only), Micherdzinski, 1969: 366.
Ologamasus (Ologamasus) inornatus: Holzmann, 1969: 47.
Holoparasitus calcaratus (Koch, 1839) sensu Schweizer, 1961: 36 (♂ only). Karg, 1971: 361.
Gamasus (Ologamasus) calcaratus Koch, 1839 sensu Halbert, 1915: 54 (part).

DEUTONYMPH. The dorsal shields are light yellowish-brown in colour, weakly sclerotised and faintly reticulated (Fig. 7A). The podonotal shield averages 460 μm long × 300 μm wide when

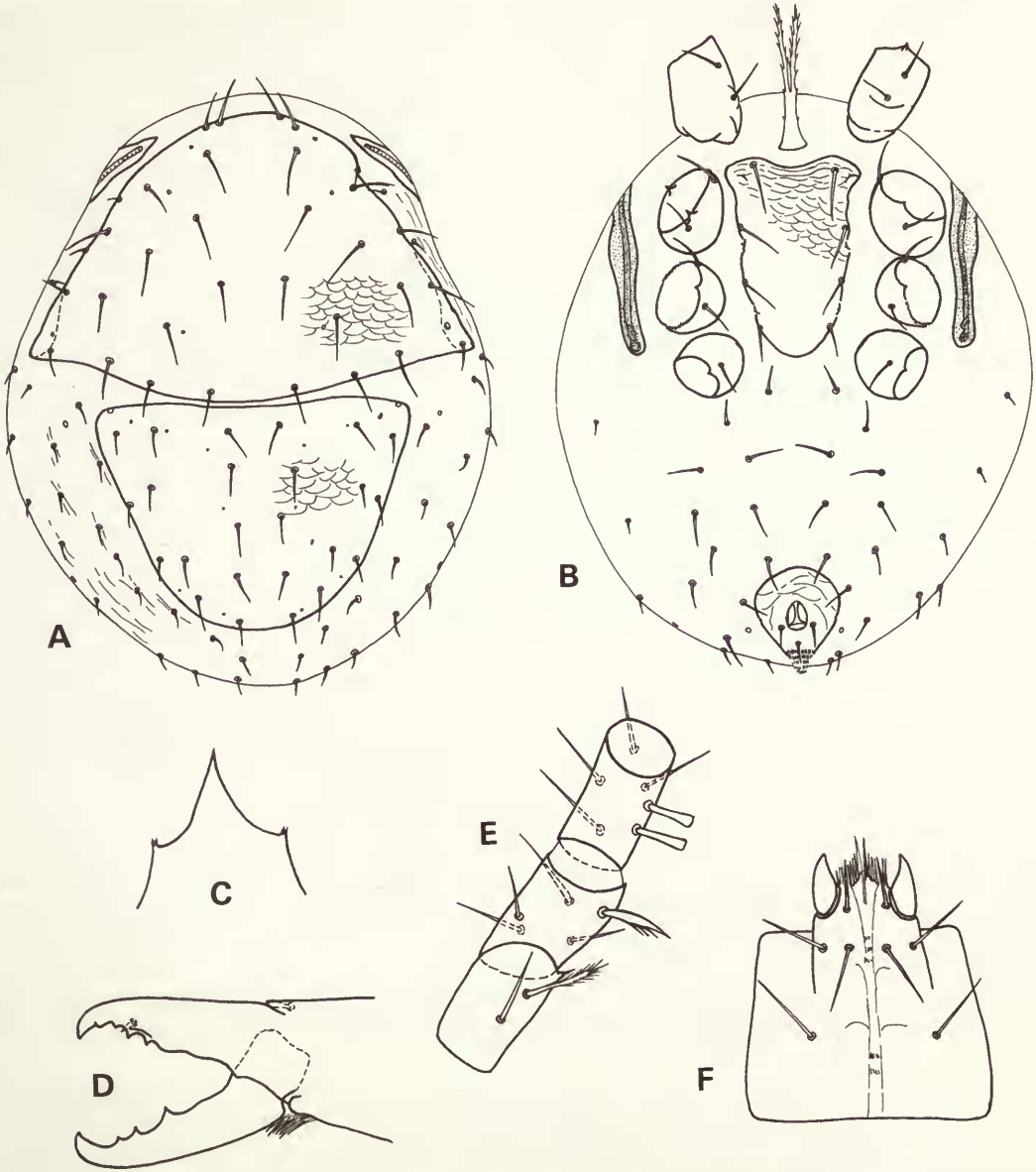

Fig. 7 *Holoparasitus inornatus* (Berlese), **deutonymph** – A dorsum, B venter, C tectum, D chelicera, E palp trochanter, femur and genu, F venter of gnathosoma.

flattened and depending on one or more of the marginal (*r*-series) setae being on or off the shield, bears 16–17 pairs of fine simple setae, none measuring more than about 35 μm. The opisthonotal shield averages 180 μm long × 210 μm wide and bears 12 pairs of simple setae up to *c.* 25 μm in length. All the dorsal setae taper extremely finely. The surrounding membrane bears dorsally on each side up to about 20 short simple setae.

The tritosternum has a narrow base and pilose laciniae. The sternal shield (Fig. 7B) measures 160–170 μm long and is lightly reticulated and weakly sclerotised. The setae are simple. Presternal shields absent. The oval anal shield bears the usual three setae, each simple and about 12–15 μm in length. The stigma is situated opposite the anterior margin of coxa IV and the granular peritreme and peritrematal shield extend anteriorly to the level of coxa I. The opisthogastric setae, which number about 17 pairs, are fine and simple.

The tectum (Fig. 7C) is triangular and is flanked by small tooth-like projections each side. The chelicera is shown in figure 7D; the movable digit measures 72 μm in the figured specimen and bears three teeth, whilst the fixed digit bears about five teeth. The palp trochanter, femur and genu are shown in figure 7E. The anterolateral seta of the femur is broad and pectinate on one margin and the two anterolateral setae of the genu are spatulate. The corniculi and venter of the gnathosoma are shown in figure 7F. The four pairs of gnathosomal setae are simple whilst the hypognathal denticles are indistinct. All leg setae are slender, the majority are simple, but a few on tarsus II are finely pilose on one margin. The ambulacra are normal, with rounded pulvilli and two claws.

MALE. The holodorsal and opisthogastric shields are fused ventrally posterior to coxae IV and are heavily sclerotised (Figs 8A, B). The dorsum, which measures 530–600 μm long × 390–460 μm wide, is strongly granular with almost no trace of reticulations (Fig. 8A). It bears, apparently, a fairly constant and symmetrically arranged number of setae, 20 pairs in the podonotal region and 30–31 pairs in the opisthonotal region. The longest setae, the verticals (*j1*), measure *c.* 30 μm and the tendency is for the setae to decrease in length towards the posterior of the dorsum where some are as short as 10 μm.

The tristosternum comprises a short base and two pilose laciniae (Fig. 8B). The sternogenital region is strongly reticulated and characteristically shaped. The anterior margin of the sternogenital shield is recessed deeply to accommodate the genital lamina and immediately posterior to sternal setae II there is a strong procurved ridge right across the shield. These two formations give this anterior region a very characteristic appearance. The posterior two-thirds of the sternogenital region are characteristically ornamented and are clearly separated from the opisthogastric region level with the posterior third of coxae IV, only the endopodal shields retaining their fusion. The sternogenital and opisthogastric setae are up to 50 μm in length, whilst the three anal setae and those around the posterior margin of the ventral surface are about 18 μm long. The stigma is situated opposite the posterior margin of coxa III and the peritreme extends anteriorly to coxa I.

The tectum is shown in figure 8C. The broad central part is acutely tapered and is flanked on each side by a short prong. The chelicera is shown in figure 8D. The movable digit is 83 μm long and bears four or five small teeth. The fixed digit bears six to eight small teeth. The palp trochanter, femur and genu are shown in figure 8E. The anterolateral setae of the genu and femur are spatulate. The corniculi (Fig. 8F) are strong and stalked and are cleft to a varying degree on their inner margins. The palpcoxal setae are finely plumose, the remaining three pairs of gnathosomal setae are simple. There are about 10 rows of hypognathal denticles. Leg II is shown in detail in figure 8G. The apophysis on femur II is short, hemispherical, and does not extend beyond the tip of the similarly shaped axillary process. The ventral processes on the genu and tibia are smooth and elongate. All leg setae are slender, some on tarsi II–IV are finely pilose on one margin. The ambulacra are normal.

FEMALE. The holodorsal and opisthonotal shields are fused ventrally posterior to coxae IV and are heavily sclerotised (Figs 9A, B). The dorsum (Fig. 9A), which measures 610–690 μm long × 420–570 μm wide, is strongly granular and, like the male, has almost no trace of reticulation. It bears about 50 pairs of simple setae, up to 23 pairs in the podonotal region and up to 27 pairs in the opisthonotal region. Setae *j1*, the verticals, are the longest, measuring about 35 μm and the remainder are slightly shorter with a minimum length of *c.* 18 μm posteriorly.

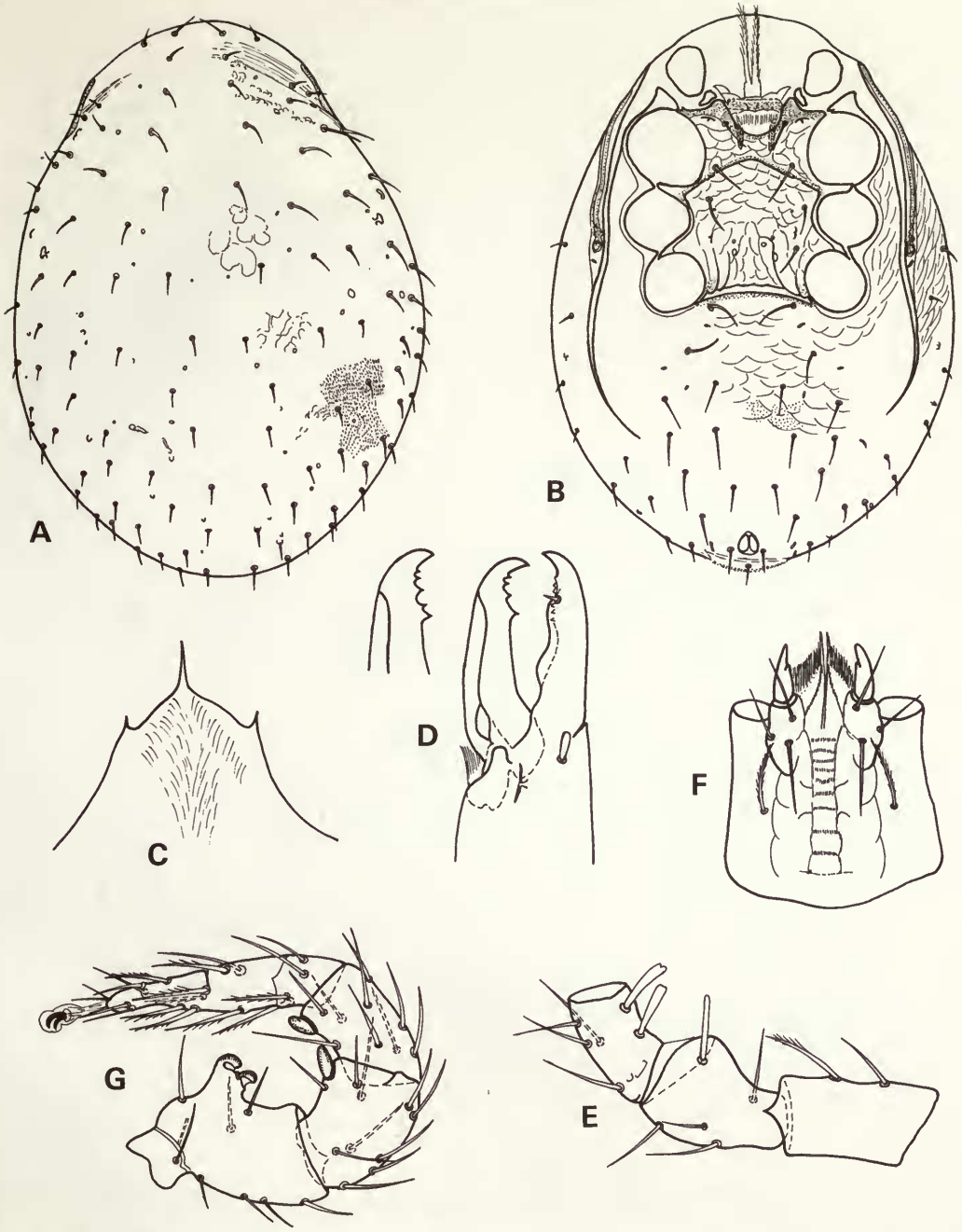

Fig. 8 *Holoparasitus inornatus* (Berlese), **male** – A dorsum, B venter, C tectum, D chelicera, E palp trochanter, femur and genu, F venter of gnathosoma, G leg II.

The tritosternum has a narrow base and pilose laciniae (Fig. 9B). The presternal shields are fused into a single narrow bar. The ventral shields are strongly reticulated and all setae are simple. The sternal shield is finely granular and is divided longitudinally at the centre. Additionally, a conspicuous procurved line passes through sternal pores II and spans the entire shield. The genital shield measures 135–160 μm long × 210–260 μm wide. Its apex is formed almost as a right

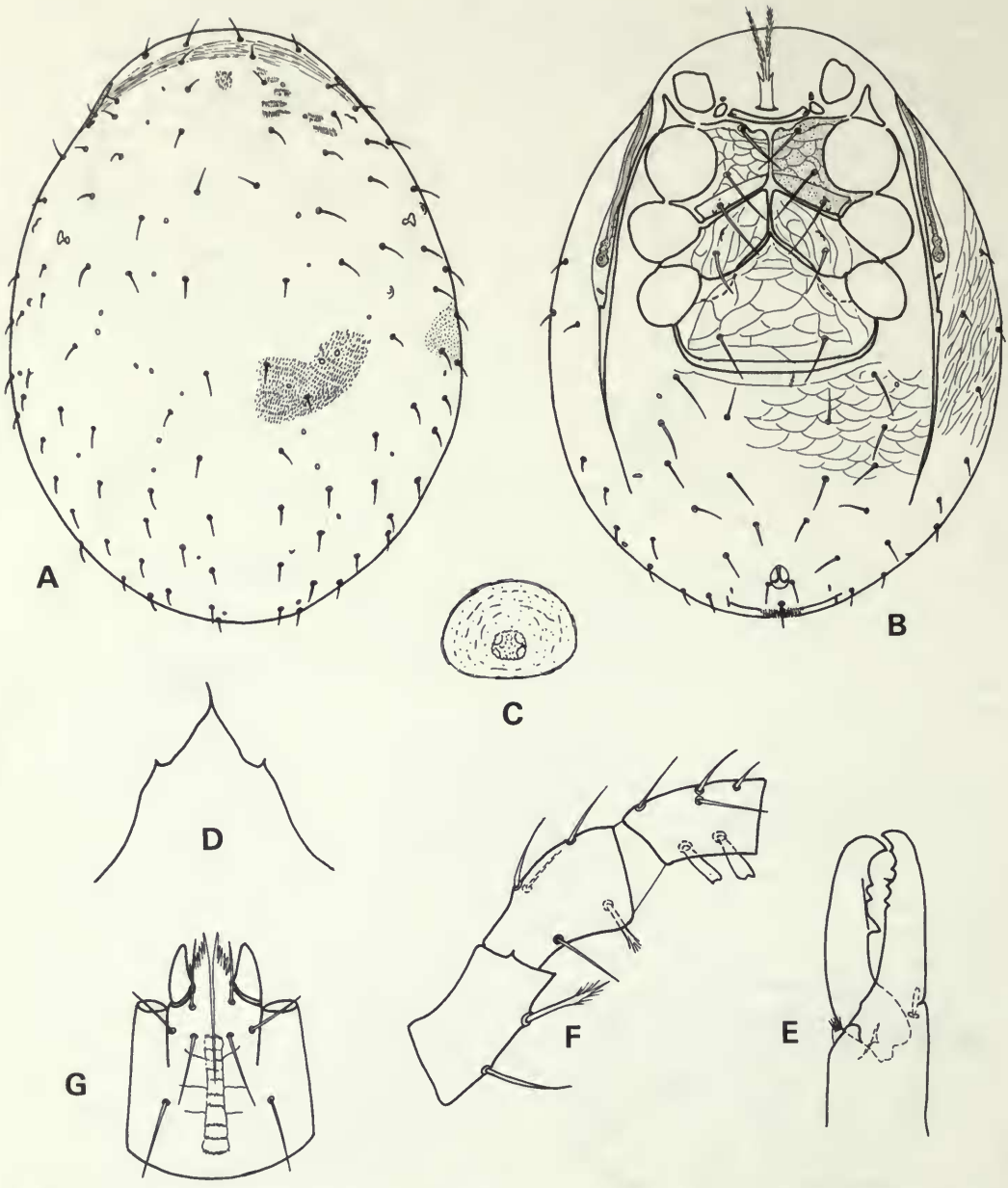

Fig. 9 *Holoparasitus inornatus* (Berlese), **female** – A dorsum, B venter, C endogynium, D tectum, E chelicera, F palp trochanter, femur and genu, G venter of gnathosoma.

angle and it does not bear an elongate tip. The endogynium appears to comprise simply an oval punctate area with a central detail (Fig. 9C). The opisthogastric region bears 8–9 pairs of simple setae. The longest of the ventral setae are the sternals which measure *c.* 65 μm and the shortest are around the posterior margin and measure *c.* 12 μm. The stigma is situated opposite the posterior margin of coxa III and the finely granular peritreme extends anteriorly to coxa I.

The tectum (Fig. 9D) has the centre portion finely tapered and it is flanked on each side by a single prong. The chelicera is shown in figure 9E. The movable digit measures 95 μm in the figured specimen and bears three teeth, one large and two smaller but of equal size. The fixed digit bears

four teeth, the two distals being small, the two proximals larger. The palp trochanter, femur and genu are shown in figure 9F. The anterolateral seta on the femur is pilose distally whilst the two on the genu are spatulate. The venter of the gnathosoma is shown in figure 9G. The corniculi are strongly formed and the four pairs of gnathosomal setae are simple. Ten rows of hypognathal denticles are visible. The leg setae are slender, some on tarsi II–IV are pilose on one margin. The ambulacra are normal.

MATERIAL EXAMINED. 74 samples – 4 DNN, 85 ♂♂, 225 ♀♀.

ENGLAND: Cornwall, Devon, Dorset, Hampshire, Sussex, Kent, Hertfordshire, Gloucestershire, Suffolk, Cambridgeshire (including Huntingdonshire), Norfolk, Herefordshire, Warwickshire, Nottinghamshire, Lincolnshire, Cumbria (Westmorland), N. Yorkshire, Durham, Northumberland.

SCOTLAND: Strathclyde (Argyllshire, Mull, Ulva), Tayside (Perthshire), Highland (Inverness-shire, Ross and Cromarty), Sutherland, Shetland (Fair Isle).

WALES: West Glamorgan, Dyfed (Cardiganshire), Gwynedd (Caernarvonshire, Anglesey), Clwyd (Denbighshire).

IRELAND: Leitrim, Mayo, Sligo, Clare, Kerry.

This species is recorded mainly from mosses, litter and soil in damp habitats and is one of the two most abundant representatives of the genus in the British Isles.

DISTRIBUTION. The only previous records from the British Isles that I have been able to trace and authenticate are of specimens recorded by Halbert (1915) as *Gamasus (Ologamasus) calcaratus* (in part) from Co. Mayo and by Davis (1970) as *Holoparasitus ?inornatus* from Huntingdonshire. Davis' (*loc. cit.*) single female of *?pollicipatus* is *Holoparasitus stramenti* Karg.

It is recorded from France (Berlese, 1916), Germany (Berlese, 1906, Karg, 1971) and Switzerland (Schweizer, 1961).

Holoparasitus lawrencei sp. nov.
(Figs 10A–G, 11A–G)

MALE. The holodorsal and opisthogastric shields, which are fused ventrally posterior to coxae IV, are strongly sclerotised and completely reticulated (Figs 10A, B). The dorsum (Fig. 10A) measures 780–840 μm long × 550–610 μm wide and bears around 50 pairs of simple setae that range in length from 63 μm (*j1*) to 18 μm in the opisthonotal region. The figured specimen measures 820 μm long × 610 μm wide and bears apparently 46 setae on the left side of the dorsum and 51 on the right side. As can be seen from the figure, the setae are not entirely arranged symmetrically.

The tritosternum comprises two slender pilose laciniae that arise from below the anterior margin of the genital lamina (Fig. 10B). The sternogenital region is strongly reticulated and bears a strongly procurved line between coxae II and a similar, but less conspicuous, line between coxae III and IV. The sternogenital and median opisthogastric setae are up to 65 μm in length, whilst the three simple anal setae and the posterior ventral setae are about 20 μm long. The stigma is situated opposite the posterior margin of coxa III and the strongly granular peritreme extends to coxa I.

The tectum (Fig. 10C) is trispinate and the centre prong is long and sinuous and may be broken off. The chelicera is shown in figure 10D. The movable digit is 92 μm long in the figured specimen and bears no distinct teeth. The fixed digit bears apparently only one rudimentary tooth adjacent to the pilus dentilis. The palp trochanter, femur and genu are shown in figure 10E. The anterolateral setae of the femur and genu are spatulate, that of the genu is pilose on one margin. The venter of the gnathosoma is shown in figure 10F. The corniculi are strong and stalked, the palpcoxal setae are pilose whilst the remaining three pairs are simple, and the hypognathal groove bears about eleven rows of denticles. Leg II is shown in detail in figure 10G. The femoral apophysis is short and does not extend beyond the blunt axillary process. The ventral processes on the genu and tibia are shallow and directed anteriorly. All leg setae are slender, a number on the tarsi and tibiae of legs II–IV are stronger and pilose on one margin. The ambulacra are normal.

FEMALE. The holodorsal and opisthonotal shields, which are strongly scelerotised and completely reticulated, are fused ventrally anterior to the anus (Figs 11A, B). The dorsum (Fig. 11A) measures

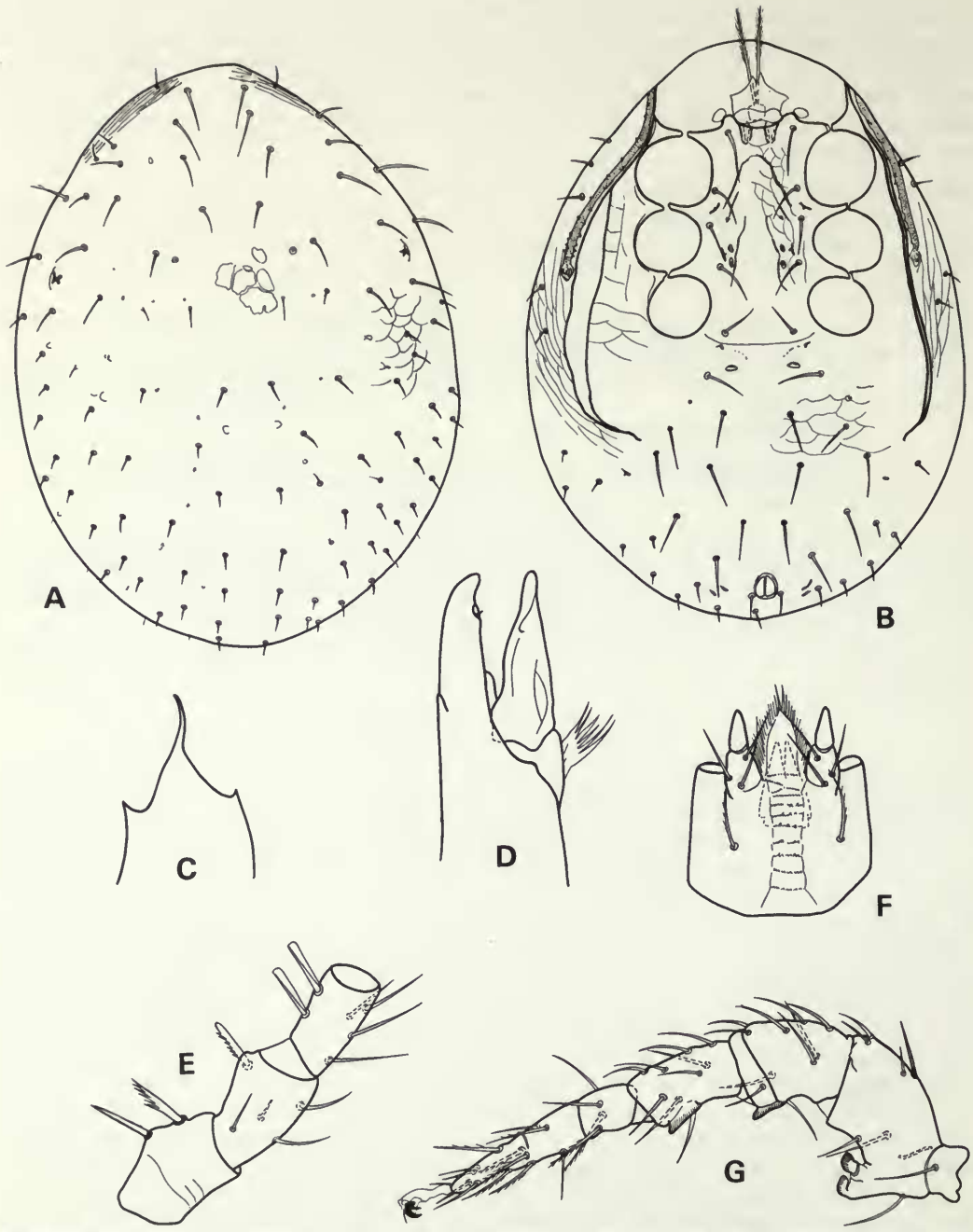

Fig. 10 *Holoparasitus lawrencei* sp. nov., **male** – A dorsum, B venter, C tectum, D chelicera, E palp trochanter, femur and genu, F venter of gnathosoma, G leg II.

850–920 μm long × 650–710 μm wide and bears up to 49 or more pairs of simple setae, about 20 pairs in the podonotal region and from 29–31 pairs in the opisthonotal region. The figured specimen – the holotype – measures 870 μm long × 660 μm wide and bears 35 setae on the podonotum, 17 on the left and 18 on the right, and 60 setae on the opisthonotum, 31 on the left and 29 on the right. The vertical setae, *j1*, and setae *j2* are the longest, measuring 50 μm or more, whilst

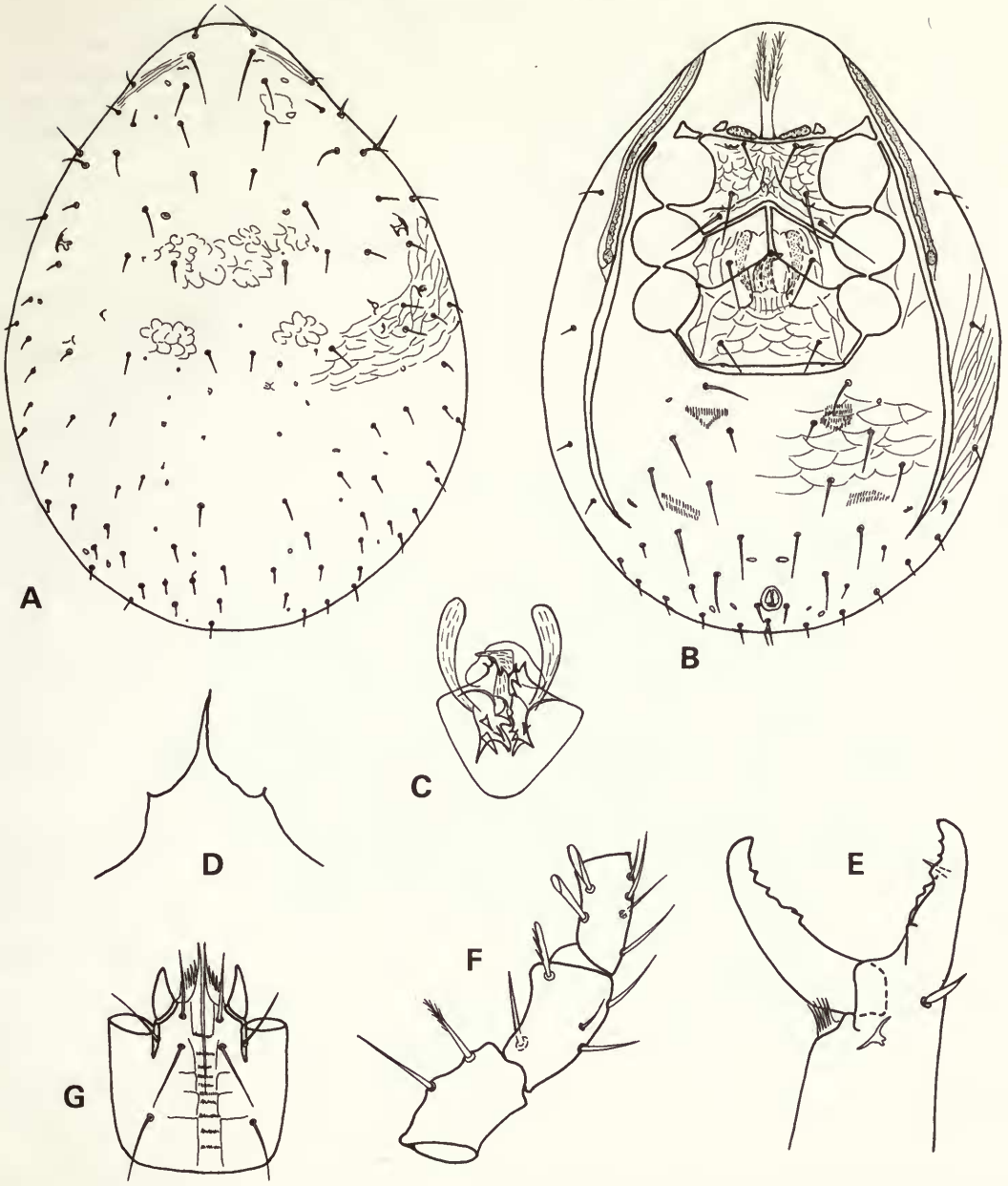

Fig. 11 *Holoparasitus lawrencei* sp. nov., **female** – A dorsum, B venter, C endogynium, D tectum, E chelicera, F palp trochanter, femur and genu, G venter of gnathosoma.

the shortest setae, the majority of those in the opisthonotal region, measure as little as 12 μm and are extremely fine.

The tritosternum (Fig. 11B) has a narrow base and pilose laciniae. The presternal shields are coarsely granular and may be entire or divided medially. The ventral shields are reticulated and all setae are simple. The sternal shield bears a pair of lines originating from the angle between coxae II and III and passing through sternal pores II and almost meeting at the centre of the shield. The genital shield measures 170–180 μm long × 265–280 μm wide. In the figured specimen – the holotype – it measures 170 μm × 280 μm. Its anterior margin is formed into slightly more than a right

angle and does not have an extended tip. The endogynium is shown in figure 11C. It appears to distort easily. The opisthogastric region bears 8–10 pairs of setae. The longest of the ventral setae are probably sternal setae II, being up to 75 μm, whilst the shortest, in the opisthogastric region, measure only *c.* 12 μm. The three simple anal setae are also short. In the type the post-anal seta is bifid. The stigma is situated opposite the posterior margin of coxa III and the peritreme extends to the level of coxa I.

The tectum (Fig. 11D) is very similar to that of the male. The chelicera is as in figure 11E. The movable digit measures 125 μm in the figured specimen and bears three blunt teeth, whilst the fixed digit bears five blunt teeth. The palp trochanter, femur and genu are shown in figure 11F. The anterolateral seta of the femur is broad with one edge pectinate, whilst those of the genu are spatulate. The venter of the gnathosoma is shown in figure 11G. The setae are simple, and the hypognathal groove bears ten rows of denticles. The majority of the leg setae are fine and simple, but some of the distal setae on tarsi II–IV are pilose on one margin. The ambulacra are normal.

MATERIAL EXAMINED. 16 samples – 20 ♂♂, 16 ♀♀.

ENGLAND: **Cornwall** – Hayle, the **holotype** ♀ (1984.12.4. 1) collected by Mr P. N. Lawrence from dry, light, leaf-litter, 24.5.1975: Lelant, St Ives, 1 ♂ in a carrion trap on salt marsh and 1 ♀ in a garden trap, 1943 (Dr F. A. Turk) (these specimens not included in the type series); **Isles of Scilly** – St Agnes, 1 ♀ **paratype** (1984.12.4. 9) from litter under *Pittosporum*, 5.11.1959 (K. H. Hyatt); **Somerset** – Bath, Kennet and Avon Canal, 1♂ **paratype** (1984.12.4. 16) from moss, humus, etc., 10.3.1962 (P. N. Lawrence); **Hampshire** – Milford-on-Sea, 1 ♀ **paratype** (1984.12.4: 30) with no data (A. S. Hirst): Isle of Wight, 1 ♂ **paratype** (1984.12.4. 3) with no habitat data, April 1948 (T. A. Lloyd); **Oxfordshire** – Oxford, 1 ♂, 1 ♀ **paratypes** (1984.12.4. 17–18) from the nest of blackbird *Turdus merula*, August 1979 (Miss A. Warburton); **Norfolk** – Blackborough, 1 ♂ **paratype** (1984.12.4. 2) with no habitat data, 25.2.1969 (Miss A. Reeve); **Suffolk** – Westleton Heath, 3 ♂♂ **paratypes** (1984.12.4. 13–15) from algae on rotten wood, 7.3.1964 (P. N. and Mrs K. Lawrence); **Lincolnshire** – no locality, 1 ♀ **paratype** (1925.6.24. 584) with no habitat data, 1900 (C. F. George); **Cumbria (Lancashire)** – Grange-over-Sands, 3 ♂♂, 2 ♀♀ **paratypes** (1984.12.4. 4–8) from tree-holes, 27.1.1954 (D. Macfarlane); **Cumbria (Cumberland)** – Newton Arlosh, Carlisle, 1 ♂, 2 ♀♀ **paratypes** (1973.28) with no data (J. E. Hull).

SCOTLAND: **Tayside (Perthshire)** – Glen Farg, 2 ♂♂ **paratypes** (1984.12.4. 19–20) from mosses on deciduous trees, 24.9.1982 (K. H. Hyatt); **Dumfries and Galloway (Wigtownshire)** – Moss of Cree, 5 ♂♂, 4 ♀♀ **paratypes** (1984.12.4. 21–29) from moss in birch tree-holes, 16.9.1982 (K. H. Hyatt).

WALES: **Dyfed (Cardiganshire)** – Dol-y-Bont, 1 ♀ **paratype** (1984.12.4. 12) from damp moss, 15.8.1957 (Dr G. O. Evans).

IRELAND: **Clare** – Lough Inchiquin, 1 ♂, 1 ♀ **paratypes** (1984.12.4. 10–11) from litter near a weir, June/July 1971 (P. N. Lawrence).

This species is named after Mr P. N. Lawrence whose diligent collecting of soil arthropods has done much to increase our knowledge of the British and Irish faunas.

Holoparasitus maritimus sp. nov.
(Figs 12A–F, 13A–H, 14A–G)

Holoparasitus calcaratus: Browning, 1956: 386, Non Koch, 1839.

DEUTONYMPH. The dorsal shields are pale yellowish brown in colour, lightly sclerotised and reticulated (Fig. 12A). The podonotal shield measures 260–280 μm long × up to 480 μm wide, depending on the degree of lateral displacement of the posterior region as shown in the figure. The figured specimen bears essentially 18 pairs of setae although the left *j2* is missing. Setae *j1*, the verticals, measure *c.* 35 μm whilst the remainder reduce in length to *c.* 18 μm on the margins. The opisthonotal shield measures 190–240 μm long × 260–290 μm wide and bears 13 pairs of setae, although in the figured specimen the right *Z3* is missing. The setae range in length from 18—22 μm. The surrounding membrane bears dorsally on each side from 30–40 fine setae not exceeding 18 μm in length.

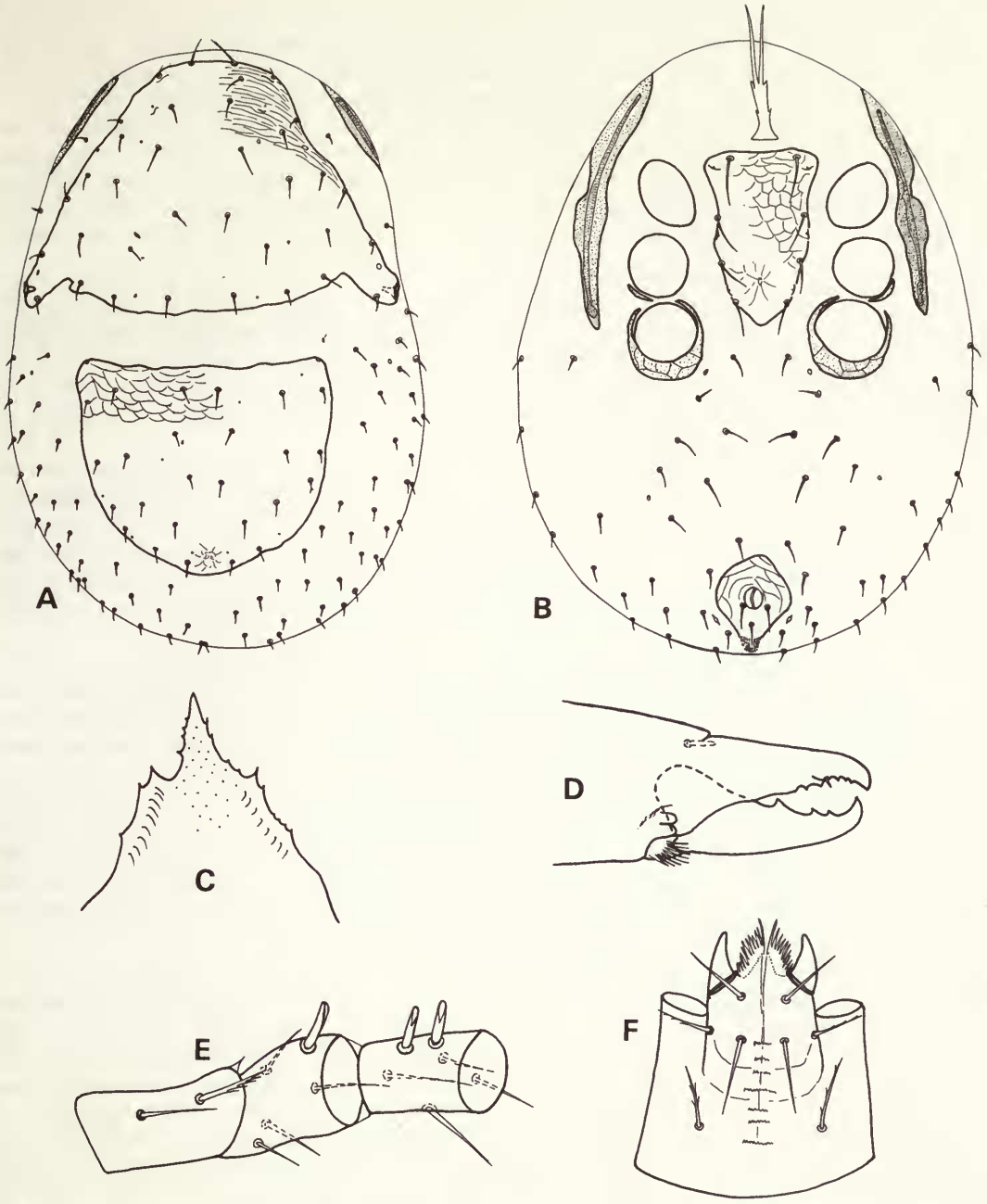

Fig. 12 *Holoparasitus maritimus* sp. nov., **deutonymph** – A dorsum, B venter, C tectum, D chelicera, E palp trochanter, femur and genu, F venter of gnathosoma.

The tritosternum has a narrow base and simple laciniae. The sternal shield (Fig. 12B) measures 160–170 μm long and is lightly sclerotised and entirely reticulated. The setae are simple. Presternal shields absent. The oval anal shield bears the usual three setae and is reticulated. The stigma is situated opposite the anterior margin of coxa IV and the granular peritreme and irregularly outlined peritrematal shield extend to coxa I. The opisthogastric setae number upwards of 16 pairs depending on the actual position of those towards the posterior margin.

The tectum (Fig. 12C) is essentially triangular and bears strong lateral teeth, but is irregularly outlined. The chelicera is shown in figure 12D. The movable digit measures 78 μm in the figured specimen and bears three widely spaced teeth. The fixed digit bears five or six smaller teeth. The palp trochanter, femur and genu are shown in figure 12E. The anterolateral setae of the femur and genu are spatulate. The corniculi and the venter of the gnathosoma are shown in figure 12F. The anterior and the internal posterior hypostomatic setae are simple whilst the external hypostomatic and the palpcoxal setae are lightly pilose on one margin. About seven rows of hypognathal denticles are present. All the leg setae are slender and the majority are simple, but a few on tarsus II are finely pilose on one margin. The ambulacra are normal, with rounded pulvilli and two claws.

MALE. The holodorsal and opisthogastric shields are fused ventrally posterior to coxae IV. They are heavily sclerotised and entirely reticulated (Figs 13A, B). The dorsum (Fig. 13A) measures 680–750 μm long × 425–500 μm wide and bears about 60 pairs of simple setae that range in length from *c.* 55 μm (setae *j1*) to 12 μm in the opisthonotal region. The figured specimen measures 730 μm long × 450 μm wide and bears apparently 60 pairs of setae on the left side and 58 pairs on the right side. The podonotal region bears 19 pairs of setae arranged symmetrically, whilst the opisthonotal region bears 41 setae on the left side and 39 on the right side.

The tritosternum comprises two slender pilose laciniae that arise from below the anterior margin of the genital lamina (Fig. 13B). The anterior margin of the sternogenital shield is moderately recessed medially. The ornamentation of the sternogenital region is without a characteristic pattern. The sternogenital setae are about 60 μm in length whilst the opisthogastric setae are shorter. The three anal setae are simple and like those in the posterior region of the opisthogastric shield measure approximately 18 μm. The stigma is situated opposite the posterior margin of coxa III and the peritreme extends anteriorly to coxa I.

The tectum is strongly granular and produced normally into a triangular process (Fig. 13C). However, in the figured specimen it is irregularly formed as shown in figure 13D. The chelicera is shown in figure 13E. The movable digit is 97 μm long and bears one large tooth and four to five small teeth. The fixed digit bears up to seven very small teeth. The palp trochanter, femur and genu are shown in figure 13F. The anterolateral seta of the femur is broad and slightly pectinate on one margin and the two anterolateral setae of the genu are spatulate. The corniculi (Fig. 13G) are stalked and are deeply cleft on their inner margins. The gnathosomal setae are all simple and there are up to 13 rows of hypognathal denticles. Leg II is shown in figure 13H. The apophysis on femur II is short, hemispherical, and does not extend beyond the tip of the swollen axillary process. The ventral processes on the genu and tibia are smooth and elongate. All leg setae are slender, some on tarsi II–IV are finely pilose on one margin. The ambulacra are normal.

FEMALE. The holodorsal and opisthonotal shields are strongly sclerotised and fused ventrally anterior to the anus (Figs 14A, B). The dorsum (Fig. 14A) is reticulated except in the median podonotal region where it is strongly granular. It measures 770–810 μm long × 520–560 μm wide and bears up to about 60 pairs of simple setae, about 20 pairs in the podonotal region and up to 40 pairs in the opisthonotal region. The figured specimen – the holotype – measures 800 μm long × 530 μm wide and bears 20 pairs of setae in the podonotal region, whilst in the opisthonotal region there are 39 setae on the left side and 34 on the right. The vertical setae, *j1*, are the longest, measuring *c.* 55 μm, whilst the remainder reduce gradually in length towards the posterior of the dorsum where the shortest are *c.* 15 μm.

The tritosternum has a narrow base and pilose laciniae (Fig. 14B). The presternal shields are fused medially and are strongly denticulate over most of their surface. The sternal shield bears a characteristic ornamentation which shows up clearly in alchohol under low magnification. There is a longitudinal median design and two pairs of liniae which form part of the reticulation. The anterior-most lines run almost diagonally from the centre of the shield towards the anterior corners, whilst the second pair runs from the centre through sternal pores II. The genital shield measures 160–165 μm long × 240–260 μm wide. In the figured specimen – the holotype – it measures 165 μm × 250 μm. Its anterior margin is almost right-angled medially and forms a short broad tip. The endogynium is shown in figure 14C and appears to distort easily. The opisthogastric

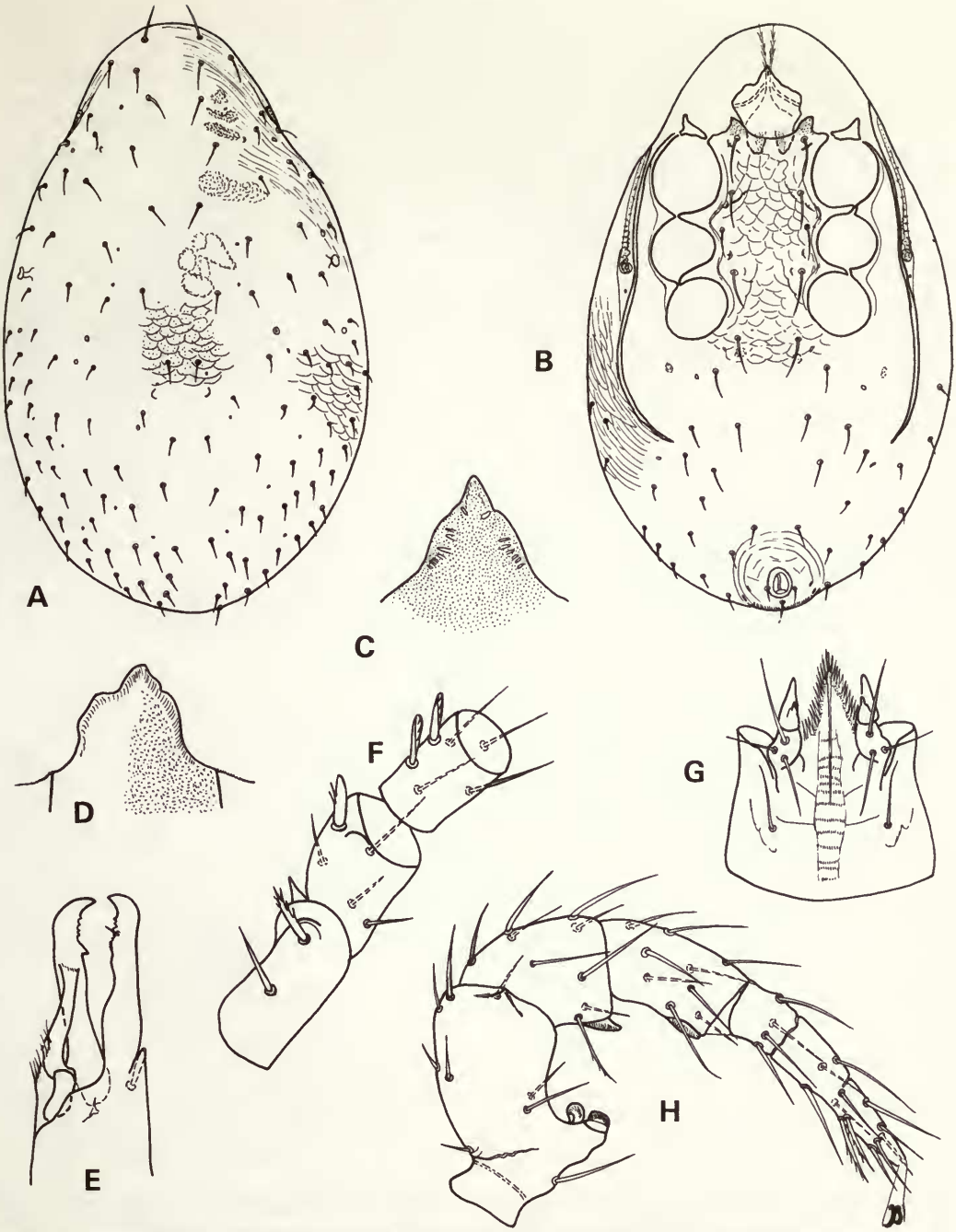

Fig. 13 *Holoparasitus maritimus* sp. nov., **male** – A dorsum, B venter, C, D tectum, E chelicera, F palp trochanter, femur and genu, G venter of gnathosoma, H leg II.

region bears 8–9 pairs of setae. The three anal setae are short (*c.* 18 μm) and similar in length to the posterior-most ventral setae. The stigma is situated opposite the posterior margin of coxa III and the peritreme extends anteriorly to coxa I.

The tectum (Fig. 14D) is granular and produced into a strong median spine and small lateral spines. The chelicera is shown in figure 14E. The movable digit measures *c.* 108 μm long and bears

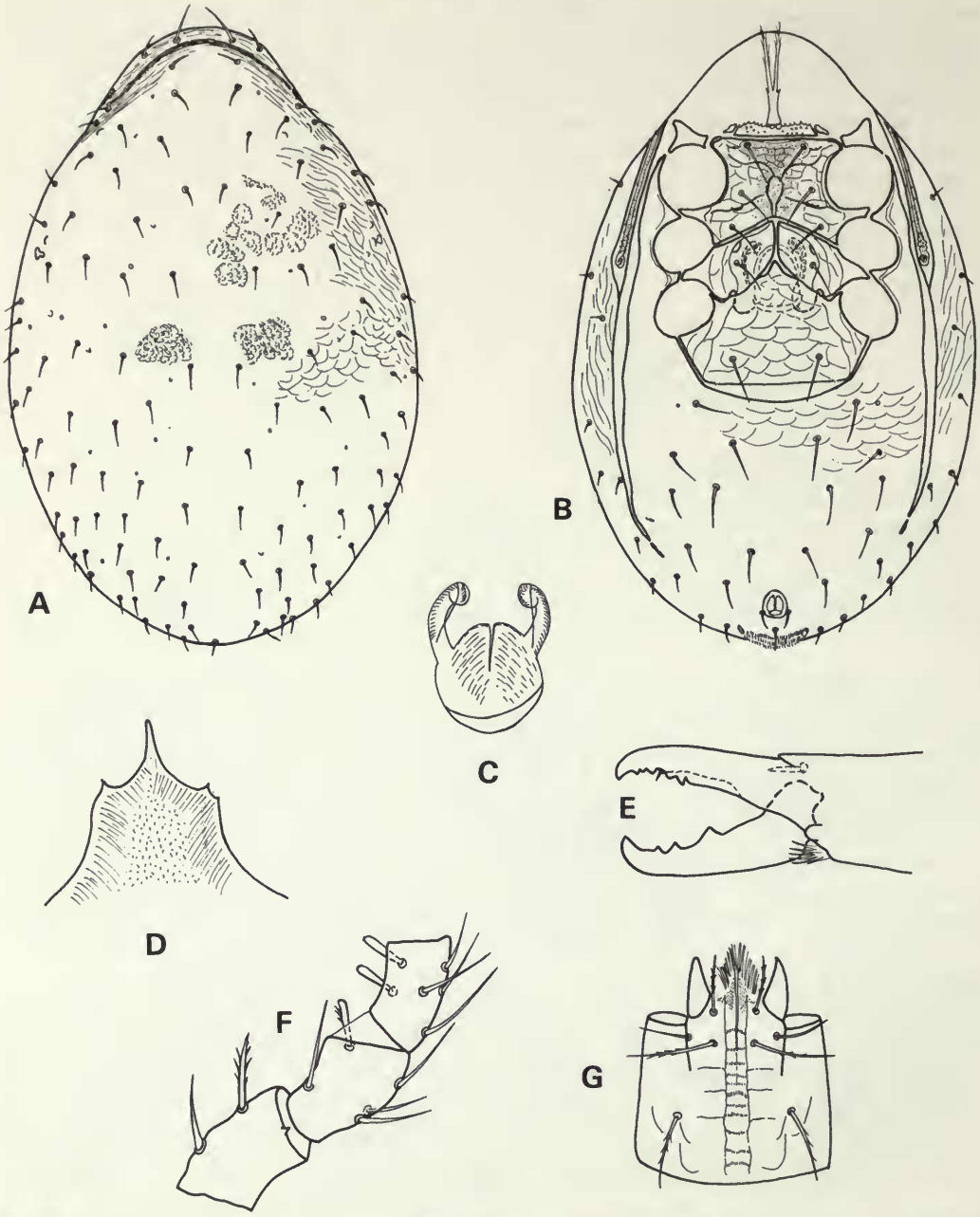

Fig. 14 *Holoparasitus maritimus* sp. nov., **female** – A dorsum, B venter, C endogynium, D tectum, E chelicera, F palp trochanter, femur and genu, G venter of gnathosoma.

three strong teeth. The fixed digit bears at least six smaller teeth. The palp trochanter, femur and genu are shown in figure 14F. The anterolateral setae on the femur and genu are spatulate, that on the femur being pilose on one margin. The venter of the gnathosoma is shown in figure 14G. The external posterior hypostomatic setae are simple, the remaining three pairs are lightly pilose. There are up to 11 rows of hypognathal denticles. The majority of the leg setae are fine and simple, but some on tarsi II–IV are pilose on one margin. The ambulacra are normal.

MATERIAL EXAMINED. 8 samples – 6 DNN, 16 ♂♂, 20 ♀♀.

ENGLAND: **Cornwall** – Kelsey Head, the **holotype** ♀ (1984.12.4. 31) and 4 DNN, 8 ♂♂, 16 ♀♀ **paratypes** (1984.12.4. 32–43) from thrift *Armeria maritima,* etc., on cliffs, 20.5.1975 (P. N. Lawrence coll.): Land's End, 1 ♀ **paratype** (1984.12.4. 46) from mossy turf, 26.5.1975 (P. N. Lawrence): Phillack, Hayle, 2 ♀♀ **paratypes** (1984.12.4. 47–48) from dried seaweed, 24.5.1975 (P. N. Lawrence): Porthleven, 2 DNN, 3 ♂♂ **paratypes** (1984.12.4. 49–53) from mossy cliff turf, 29.5.1975 (P. N. Lawrence); **Isles of Scilly** – St Agnes, 2 ♂♂ **paratypes** (1984.12.4. 44–45) from thrift and grasses on rocks by seashore, 7.4.1957 (K. H. Hyatt).

SCOTLAND: **Inner Hebrides** – Iona, 1 ♂ **paratype** (1984.12.4. 55) from sandy beach grass with *Fucus*, 3.6.1970 (P. N. Lawrence).

CHANNEL ISLANDS: **Jersey** – Elizabeth Castle, 1 ♂ **paratype** (1954.3.19. 49) from vegetation on cliff-face, 30.8.1951 (Dr G. O. Evans). This specimen was recorded by Browning (1956) as *Holoparasitus calcaratus* (C. L. Koch).

Acknowledgements

Of the many collectors who have donated specimens to the British Museum (Natural History) my special thanks go to Mr P. N. Lawrence, formerly in the Department of Entomology.

Colleagues in other institutions have kindly loaned material: Dr L. van der Hammen, Rijksmuseum van Natuurlijke Historie, Leiden (Oudemans), Dr M. V. Hounsome, Manchester Museum (Britten) and Dr J. P. O'Connor, National Museum of Ireland, Dublin (Halbert). Dr F. A. Turk, Camborne, Cornwall, kindly loaned specimens from his own collection. Miss A. S. Baker compared my drawings with material in the Berlese collection in Florence and Mr K. P. Martyn prepared the distribution map.

References

Berlese, A. 1888. Acari Austro-Americani quos collegit Oloysius Balzan. Manipulus primus. *Boll. Soc. ent. ital.* **20:** 171–222.

—— 1892. *Acari, Myriopoda et Scorpiones hucusque in Italia reperta. Ordo Mesostigmata* (*Gamasidae*). Padova, 143 pp.

—— 1904. Acari nuovi. Manipulus I. *Redia* **1:** 235–252.

—— 1906. Monografia del genere *Gamasus* Latr. *Redia* **3:** 66–304.

—— 1913. *Acarotheca Italica.* Firenze, Fasc. **II:** 202–204.

—— 1916. Centuria seconda di Acari nuovi. *Redia* **12:** 125–177.

Bhattacharyya, S. K. 1963. A revision of the British mites of the genus *Pergamasus* Berlese s. lat. *Bull. Br. Mus. nat. Hist.* (Zool.) **2:** 131–242.

Block, W. C. 1965. Distribution of soil mites (Acarina) on the Moor House National Nature Reserve, Westmorland, with notes on their numerical abundance. *Pedobiologia* **5:** 244–251.

Browning, E. 1956. On a collection of Arachnida and Myriapoda from Jersey, Channel Islands, with a check list of the Araneae. *Bull. a. Soc. jersiaise* **16:** 377–394.

Davis, B. N. K. 1963. A study of micro-anthropod communities in mineral soils near Corby, Northants. *J. Anim. Ecol.* **32:** 49–71.

—— 1970. Some Acarina from Monks Wood National Nature Reserve. *Entomologist's mon. Mag.* **105:** 220–223.

Evans, G. O. 1957. An introduction to the British Mesostigmata (Acarina) with keys to families and genera. *J. Linn. Soc.* Zool. **43:** 203–259.

—— **& Till, W. M.** 1979. Mesostigmatic mites of Britain and Ireland (Chelicerata: Acari – Parasitiformes). *Trans. zool. Soc. Lond.* **35:** 139–270.

Halbert, J. N. 1915. Clare Island Survey, Part 39ii Acarinida: Section II – Terrestrial and marine Acarina. *Proc. R. Ir. Acad.* **31:** 45–136.

Holzmann, C. 1969. Die Familie Parasitidae Oudemans 1901 (Eine systematische Studie aus dem Jahre 1955). *Acarologie* **13:** 3–24, 25–55.

Hull, J. E. 1918. Terrestrial Acari of the Tyne Province. *Trans. nat. Hist. Soc. Northumb.* **5,** 1: 13–88.

Hyatt, K. H. 1980. Mites of the subfamily Parasitinae (Mesostigmata: Parasitidae) in the British Isles. *Bull. Br. Mus. nat. Hist.* (Zool.) **38:** 237–378.

Juvara-Bals, I. 1972. *Mixogamasus*, un nouveau genre de Parasitidae (Acariens: Anactinotriches) de Romanie. *Acarologia* **14:** 3–14.

—— 1976. Sur le genre *Holoparasitus* Oudemans et sur certains caractères morphologiques de la famille Parasitidae Oudem. (Parasitiformes). *Acarologia* **17:** 384–409.

Karg, W. 1971. Acari (Acarina), Milben Unterordnung Anactinochaeta (Parasitiformes). Die freilebenden Gamasina (Gamasides), Raubmilben. *Tierwelt Dtl.* **59,** 475 pp.

Koch, C. L. 1839. *Deutschlands Crustaceen, Myriapoden und Arachniden.* Regensburg, Heft 26, no. 6.

Lee, D. C. 1970. The Rhodacaridae (Acari: Mesostigmata); classification, external morphology and distribution of genera. *Rec. S. Aust. Mus.* **16** (3): 1–219.

Mead-Briggs, A. R. & Hughes, A. M. 1966. Records of mites and lice from wild rabbits collected throughout Great Britain. *Ann. Mag. nat. Hist.* (13), **8:** 695–708.

Micherdzinski, W. 1969. *Die Familie Parasitidae Oudemans 1901 (Acarina, Mesostigmata).* Kraków (Państwowe Wydawnictwo Naukowe), 690 pp. [German. Polish and Russian summaries].

Oudemans, A. C. 1901. Notes on Acari, Ser. 3. *Tijdschr. ned. dierk. Vereen.* **7:** 50–88.

—— 1929. Kritisch Historisch Overzicht der Acarologie. II, 1759–1804. *Tijdschr. Ent.* **72,** Suppl.: 1–1097.

—— 1936. *Kritisch Historisch Overzicht der Acarologie (Critico-historical survey of Acarology).* Leiden (Brill), IIIA, 1805–1850, 430 pp.

Ryke, P. A. J. 1962. The subfamily Rhodacarinae with notes on a new subfamily Ologamasinae (Acarina: Rhodacaridae). *Ent. Ber., Amst.* **22:** 155–162.

Schrank, F. von P. von. 1781. *Enumeratio Insectorum Austriae Indigenorum.* Augustae Vindelicorum, 548 pp.

Schweizer, J. 1961. Die Landmilben der Schweiz (Mittelland, Jura und Alpen). Parasitiformes Reuter. *Denkschr. schweiz. naturf. Ges.* **84:** 1–207.

Sellnick, M. 1968. Zwei neue *Pergamasus*-Arten aus Österreich. *Ber. naturw.-med. Ver. Innsbruck* **56:** 463–472.

Turk, F. A. 1953. A synonymic catalogue of British Acari. *Ann. Mag. nat. Hist.* (12) **6:** 1–26, 81–99.

—— **& Turk, S. M.** 1952. Studies on Acari. 7th series: Records and descriptions of mites new to the British fauna, together with short notes on the biology of sundry species. *Ann. Mag. nat. Hist.* (12) **5:** 475–506.

Vitzthum, H. v. 1923. Acarologische Beobachtungen. 7. Reihe. *Arch. Naturgesch.* **89A,** 2: 97–181.

Willmann, C. 1940. Neue Milben aus Höhlen der Balkanhalbinsel, gesammelt von Prof. Dr K. Absolon, Brünn (2. Mitteilung). *Zool. Anz.* **130:** 209–218.

—— 1941. Die Acari de Höhlen der Balkanhalbinsel. (Nach dem Material der "Biospeologica balcanica".) *Studie Oboru všeol. kras. Nauky* B. Biol. Ser. **8** (14), 80 pp.